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INTRODUCTION

The National Forest Management Act (16 U.S.C. 1600) requires the Forest Service to maintain viable populations of existing native and desired non-native wildlife in the planning area (36 CFR 219.19). Guidelines for each planning area must provide for a diversity of plant and animal communities based on the suitability of the specific land area. Section 7 of the Endangered Species Act (ESA) requires the Forest Service ensure its actions do not jeopardize the existence of Federally listed species. The Forest Service established a Sensitive Species Program and a Biological Evaluation process (FSM 2672.4) to ensure compliance with these laws.

Regional Foresters are responsible for identifying and maintaining a list of sensitive species occurring within their Region. This list includes species for which there is a documented concern for viability within one or more administrative units within the species' historic range (FSM 2670.22, WO Amendment 2600-95-7). These species may require special management emphasis to ensure their viability and to preclude trends toward endangerment that would result in the need for Federal listing. There are currently seventeen wildlife species listed as "sensitive" that occur or are suspected of occurring on the Umpqua National Forest (Attachment 1).

Biological Evaluations incorporate concerns for sensitive species into the planning process and provide a standard by which to ensure that they, and Federally listed species, receive full consideration in the decision-making process (FSM 2672.41). This analysis and Biological Evaluation addresses four alternatives associated with the proposed Diamond Lake Restoration Project and their effects on sensitive wildlife species, including federally listed species and designated critical habitats. In doing so, it reviews the proposed project alternatives for consistency with the Umpqua National Forest Land and Resource Management Plan (1990) as amended by the Northwest Forest Plan (1994) and includes an analysis of effects on Survey and Manage wildlife species, Landbirds and Management Indicator Species. Other potentially, impacted wildlife species, not routinely addressed, are also analyzed for purposes of full disclosure.

PROJECT AREA OVERVIEW

The area being analyzed in the Diamond Lake Restoration Project EIS encompasses Diamond Lake, Lake Creek, Lemolo Lake, and the North Umpqua River. The project area is Diamond Lake proper, located on the Diamond Lake Ranger District, Umpqua National Forest within the Umpqua River Basin. The project area is bounded to the North by the North Umpqua River, to the South by Crater Lake, to the East by Mt. Thielsen, and to the West by Mt. Bailey. The project area includes all or portions of sections 30 through 32, T27S, R6E; sections 25 and 36,

T27S, R5E; sections 4 through 9 and sections 16 through 21, T28S, R51/2E, and sections 1 and 12, T28S, R5E Willamette Meridian, Douglas County, Oregon.

Diamond Lake is a natural lake located at about 5,191 feet elevation. It has a surface area of approximately 3,031 acres and is relatively shallow, with a maximum depth of 48.5 feet and an average depth of 22.5 feet (Eilers and Gubala, 2003). Diamond Lake drains into Lake Creek, which empties into Lemolo Lake, an impoundment on the North Umpqua River. Two other impoundments are located downstream from Lemolo Lake-Toketee Lake and Soda Springs Reservoir. The flow of water from Lemolo Lake and the other impoundments is regulated by PacifiCorp, a public utilities cooperation.

Diamond Lake is a high use destination recreation area[1] considered important to the economy of southern Oregon. Originally fishless, the lake has been managed as a recreational trout fishery since 1910. Tui chub were introduced into the lake in the mid-1940's and rapidly overpopulated the lake. In 1954, the Oregon Game Commission constructed a canal near the Lake Creek outlet, lowered the lake level, and treated Diamond Lake with rotenone to eradicate tui chub. The lake was restocked with trout following the rotenone treatment and a thriving fishery was maintained for several decades. In 1992, tui chub were again discovered in Diamond Lake and have since overpopulated the lake for a second time. Associated negative impacts on the recreational fishery and on water quality in Diamond Lake and down stream prompted multiple local, state, and federal agencies to work cooperatively in the exploration of restoration solutions for the lake as summarized below.

DESCRIPTION OF ALTERNATIVES

The following summarizes the information contained in Chapter 2 of the Final Environmental Impact Statement (FEIS). It is intended to provide the reader sufficient detail to understand the impacts described later in this document. Refer to Chapter 2 of the FEIS for a complete description of the alternatives being evaluated.

Alternative 1 (No Action)

This alternative serves as the baseline for estimating environmental effects of the action alternatives. No canal reconstruction, lake draw down, mechanical fish harvest, chemical treatment, fish carcass removal, or lake refill would occur. No active measures to improve water quality at Diamond Lake would be implemented. Potentially harmful algae blooms and lake closures would be expected to continue.
ODFW would continue with the existing experimental fish stocking program (100,000 fish) in 2004 and 2005. In 2006, ODFW and the Oregon Fish and Wildlife Commission (OFWC) would revisit the Diamond Lake Fishery Management Plan to determine appropriate stocking. Based on current knowledge and budget, it is expected that ODFW would stock Diamond Lake with 24,000 legal sized rainbow trout on annual basis in 2006 and beyond.

Alternative 2 (Proposed Action)

The Umpqua National Forest, in cooperation with multiple state and federal agencies, proposes to implement a series of actions that would meet the need for improvement of water quality and the recreational fishery at Diamond Lake.

[1] Estimates for recreation use at Diamond Lake are approximately 700,000 Recreation Visitor Days per year (meaning continuous or intermittent recreational use for 12 hours by an individual) (USDA 1998).

Canal Reconstruction: A blocked and debris-filled existing earthen canal that connects Diamond Lake to Lake Creek would be reconstructed to facilitate a lake draw down. The portion of the canal within Diamond Lake would be dredged to its original depth using a floating suction dredge or other appropriate equipment. Dredge spoils would be used to expand an existing wetland. From the lakeshore to the canal outlet, the canal would be excavated to its original configuration and fitted with a new head-gate structure to control water flow. If necessary, new bridges or culverts would be constructed over the canal to maintain access to the bike trail and summer homes using Forest Service Road 4795.

Fall/Winter Lake Draw Down: Diamond Lake's water level would be lowered by eight feet from its normal summer level using both the reconstructed canal and Lake Creek for water transport. The lake draw down would begin on or around September 15 in the year prior to a chemical treatment. A gravity-driven draw down would occur at a discharge rate approximating a bankfull flow in Lake Creek.

Mechanical Fish Removal and Utilization: Several methods would be used to remove and utilize fish from Diamond Lake prior to chemical treatment including: liberalizing catch limits on fishing at the lake; harvest of fish by individual crews using traps, nets and seines; and harvest of fish through commercial fishing operations. Harvested fish carcasses would be converted to an organic fish emulsion product on site (lake shore) or trucked to an off-site plant for utilization as fertilizer.

September Rotenone Treatment: The powdered formulation of the fish toxicant rotenone would be applied to Diamond Lake in September (about a year after the lake draw down begins). This would happen when water temperature and chemistry reached conditions considered optimal for achieving a complete fish kill. Rotenone would be administered according to label instructions at the necessary amounts based on water volume, temperature, and chemistry in Diamond Lake at the time of application. Sections of Silent Creek and Short Creek would also be treated with liquid rotenone.

Non-Significant Forest Plan Amendment: The proposed action would include a non-significant amendment to the 1990 Umpqua National Forest LRMP. The amendment would allow the use of rotenone within Diamond Lake, Short and Silent Creeks, which would not normally occur under Standard and Guidelines Fisheries #6 (LRMP IV-33), Water Quality/Riparian Areas #8 (LRMP IV-60) and Prescription C2-I(LRMP IV-169-171). The non-significant Forest Plan Amendment (Amendment #5) would apply to this project only; upon completion of the project, Standard and Guidelines Fisheries #6, Water Quality/Riparian Areas #8 and Prescription C2-I would again apply to Diamond Lake, and Short and Silent Creeks.

Mechanical Fish Carcass Removal and Utilization: A commercial fishing or professional fish mortality recovery and recycling operation would be employed to collect fish carcasses following a chemical treatment of the lake. Fish carcasses would be converted to an organic fish emulsion product on site or trucked to an off-site plant for utilization as fertilizer.

Water Management during Lake Refill Period: An active water management strategy would be implemented to limit the length of time that Lake Creek is reduced to no or very low flows. When water in Diamond Lake becomes suitable for release (about November), canal

headgates would be opened to allow approximately 10 cubic feet per second (cfs) of water to flow into Lake Creek and through the North Umpqua River system.

Monitoring: A variety of monitoring activities would be used to verify assumptions, evaluate project success, and formulate appropriate lake management strategies including: stream flows and water quality in Lake Creek; water quality in Diamond and Lemolo Lakes and the North Umpqua River; tui chub presence; and phytoplankton, zooplankton and benthic invertebrate and trout populations.

Fish Restocking Strategy: ODFW would pursue approval for a change to the following strategy for restocking Diamond Lake through the Oregon Fish and Wildlife Commission (OFC) and the appropriate public process.

Diamond Lake would be restocked with fish using an ecologically sustainable stocking strategy. The Oregon Department of Fish and Wildlife would manage the lake for hatchery production under the Basic Yield Alternative of Oregon's Trout Plan. However, ecological indices of lake health (i.e., zooplankton and benthic invertebrate populations), existing data and knowledge, annual fish monitoring data and applicable nutrient loading allocations provided in ODEQ's pending Total Maximum Daily Load (TMDL) publication would be used to determine appropriate numeric goals for annual fish stocking and harvest post-project.

Under this stocking strategy, it is expected that conservatively small numbers of fingerling "Fishwich" or Oak Springs rainbow trout and legal and/or trophy sized predacious fish species (Eagle Lake rainbow trout, brown trout, or spring Chinook) would be introduced into Diamond Lake as soon as the food chain recovered adequately to support them without compromising progress toward water quality goals. Annual stocking rates would be expected to increase as the food chain and water quality continued to recover.

Education: A number of educational activities would be used to reduce the likelihood of tui chub reintroduction into Diamond Lake potentially including: "angler stamps", interpretive signs and brochures, and boat inspections.

Tui Chub Contingency Plan: Because it is recognized that tui chub may be reintroduced, several actions designed to control tui chub populations would be implemented including: an extensive monitoring program to facilitate early detection of tui chub presence in the lake; stocking with predacious fish species following rotenone treatment and increasing the numbers of predacious fish if tui chub are detected; and using mechanical treatments such as netting and electro-shocking to limit tui chub population growth.

Connected Actions: A permit would be issued to Diamond Lake Resort to conduct maintenance and clean-up at the Resort Marina and the South Shore Pizza parlor dock while Diamond Lake is drawn down to eight feet below its normal level. This would involve the removal of accumulated sediment at the mouth of a tributary stream and the removal of obstacles/water hazards such as old cribbing, concrete blocks, pilings, etc. that are remnants of old boat docks and moorage.

Appendix BB of the FEIS: This appendix includes additional details on the monitoring and contingency plan and on activities designed to reduce tui chub reintroduction potential.

Alternative 3 (Put and Take Fishery)

Alternative 3 was developed to respond to the fish stocking issue. This alternative is designed to provide a recreational fishery that minimizes potential effects of stocked fish on water quality in Diamond Lake. Alternative 3 is identical to the proposed action except that it would utilize a different fish stocking strategy to restock Diamond Lake following a rotenone treatment.

Alternative 3 includes all of the following components of the proposed action described in Alternative 2: *canal reconstruction, fall/winter lake draw down, mechanical fish removal and utilization, rotenone treatment, mechanical fish carcass removal and utilization, water management during the lake refill period, monitoring, education, and a tui chub contingency plan and a non-significant amendment to the 1990 Umpqua National Forest LRMP.* Connected actions proposed by the Diamond Lake Resort would also be permitted under this alternative. Activities described in Appendix BB of the FEIS are also the same as under Alternative 2.

Additionally, under this alternative, ODFW would pursue approval for a change to the following strategy for restocking Diamond Lake with fish through the OFWC and the appropriate public process.
If approved by OFWC, management of the Diamond Lake recreational fishery would change from a Basic Yield Alternative under Oregon's Trout Plan to an Intensive Use Alternative[2]. In layman's terms this is a "put and take fishery" where legal sized fish are stocked in the spring and are harvested by anglers later in the same season.
Under this stocking strategy, it is estimated that ODFW would stock Diamond Lake annually with approximately 100,000-400,000 12-inch domesticated rainbow trout. Trout from this brood stock would not reproduce successfully in Diamond Lake, would not prey significantly on available food organisms, and the majority would not survive over winter. Diamond Lake would be stocked with domesticated trout in late spring following a fall rotenone treatment (since these fish would not require a robust existing food base). Stocking would occur periodically from late spring to early fall on an annual basis.

Subsequently, as part of the "tui chub contingency plan", legal or trophy sized predacious fish species (Eagle Lake rainbow trout, brown trout, or spring Chinook) would be introduced into Diamond Lake as soon as the food base recovered adequately to support them without compromising progress toward water quality goals. Ecological indices of lake health (i.e., zooplankton and benthic invertebrate populations), existing data and knowledge, annual fish monitoring data and applicable nutrient loading allocations provided in ODEQ's pending Total Maximum Daily Load (TMDL) publication would be used to determine appropriate numeric goals for all annual fish stocking and harvest post-project.

Alternative 4 (Mechanical/Biological)

[2] Intensive Use--"….Waters managed for this alternative are apt to be near large population centers or attract intensive angler use because of easy accessibility or location of other water-oriented recreational facilities. Many of these waters support fisheries year-round. Many of these waters can be used heavily by anglers or for short periods (April, May, and June) and afterwards be used for sailboating, water skiing, swimming, and camping. Other waters can support fisheries year-round. Some of these waters are stocked with yearling rainbow trout on a regular basis. Guidelines which apply are:…." (OAR 635-500-0115)

Alternative 4 was developed to respond to the issues of fish stocking, non-target species, water quality, wetland ecology, and human health risks associated with rotenone use. In response to public comments on the DEIS, Alternative 4 was revised between draft and final to incorporate public recommendations designed to increase its potential effectiveness at meeting the purpose and need. This alternative was designed to minimize effects of a chemical treatment and associated lake draw down on resources while limiting/controlling the tui chub population. This alternative does not include a lake draw down so potential impacts to water quality and wetland ecology from a draw down are eliminated; and it does not include a chemical treatment so potential impacts to non-target species, water quality, and health risks from chemicals are eliminated. This alternative includes a modified fish stocking strategy designed to reduce the potential impacts of a recreational fishery on water quality in Diamond Lake.

Alternative 4 would use mechanical techniques in combination with predacious fish stocking to selectively harvest chub, disrupt chub spawning and increase predation on chub, with the objective of severely diminishing chub populations over time. Alternative 4 would include education and monitoring components similar to Alternative 2. Additionally, this alternative includes all of the following components:

Annual Mechanical Harvest: Following one year of equipment and technique testing and experimentation, mechanical fish harvest treatments would occur on an annual basis for six consecutive years utilizing a variety of commercial fishing tools/techniques determined to be most effective through an adaptive management process. A combination of active and passive commercial fishing methods would be used. Potential tools include: seine nets, trawl nets, cast nets, gill nets, lampara[3] and beach seines, custom-built traps, or other types of commercial nets, seines, and traps. A detailed implementation plan is included in Chapter 2. In general, fish harvest activities would likely occur for two months in June and July prior to and during the chub spawning period at Diamond Lake. Commercial fishing operations would only occur in certain portions of the lake at a given point in time and would be rotated to different portions of the lake during the two month period. Areas where commercial fishing was occurring would be closed to recreational angling. Commercial fishing would also occur annually for approximately one month in September in an effort to harvest chub as they move from the shallows into more open water within the lake. Mechanical fish harvest treatments would target reproductive age chub. The goal of these activities would be to harvest 90-95% (or more) of the reproductive-age chub annually, while attempting to maintain a biological control (predacious fish) on the tui chub population. It is expected that annual commercial fishing operations described above would be needed to effectively limit tui chub recruitment in Diamond Lake over time.

Spawning Disruption: In addition to the above activities, electro-fishing boats would be used during the peak chub spawning period to disrupt spawning in the shallow areas of the lake that have abundant aquatic macrophytes. Where vegetation and bottom contour are favorable, a beach seine would be used to capture spawning fish in shallow areas. Nets may also be deployed to exclude fish from favored spawning areas of the lake.

Predacious Fish Stocking: ODFW would pursue approval for a change to the following strategy for restocking Diamond Lake with fish through the OFWC and the appropriate public

[3] A lampara net is a type of open water seine with tapered ends and a relatively deep, loosely hung center section. The net is set in a circle around the fish school and the two ends are brought together capturing the fish in the middle (Nielsen and Johnson 1989).

process. In general, Diamond Lake would be stocked annually with large predacious fish in sufficient numbers and of sufficient size/age classes to serve as potentially effective predators on the tui chub as well as to provide a recreational fishery. Enough catchable size trout would be released into the lake to support an improved recreational fishery. Specifically, if approved by OFWC, management of the Diamond Lake recreational fishery would change from a Basic Yield Alternative under Oregon's Trout Plan to either a Featured Species[4] or Trophy Fish Alternative[5].

Oregon administrative regulations under the Basic Yield Alternative states: "The productive capacity of the waters in this alternative will be maintained or enhanced so that no net loss of natural fish production occurs. Problem waters[6] can be transferred into a higher priority alternative. Both the Featured Species and Trophy Fish alternatives are higher priority alternatives in the Oregon Trout Plan.

A Featured Species stocking strategy would include annual stocking with legal and/or trophy sized Eagle Lake rainbow trout. A Trophy Fish stocking strategy would include annual stocking with legal and/or trophy sized brown trout or Kamloops rainbow trout. Ecological indices of lake health (i.e., zooplankton and benthic invertebrate populations), existing data and knowledge, annual fish monitoring data and applicable nutrient loading allocations provided in ODEQ's pending TMDL publication would be used to determine appropriate numeric goals for annual fish stocking and harvest post-project. However, the following summarizes estimated fish stocking under this alternative:

2005: 15,000 – 20,000 two to four pound predacious trout or other predacious fish and 85,000 catchable to trophy size domestic rainbow trout;

2006: 15,000 – 20,000 two to four pound predacious trout or other predacious fish and 150,000 catchable to trophy size domestic rainbow trout;

2007 – 2011: 7,500 – 10,000 two to four pound predacious trout or other predacious fish and 230,000 catchable to trophy size domestic rainbow trout.

This alternative would use experimental stocking and adaptive management to select a species of predacious fish to be introduced into the lake in subsequent years to serve as predators on the tui chub.

Contingency Plan: It is expected that following 6 years of full scale mechanical removal (approximately 2011), the tui chub population in Diamond Lake would be greatly diminished. It is also acknowledged that annual tui chub removal and spawning disruption activities would be needed to effectively limit tui chub recruitment in Diamond Lake over time. Additionally, it is assumed that the likelihood of achieving or maintaining improvements in the water

[4] Featured Species and Waters—Management under this alternative emphasizes species or stocks that are uncommon or unique and waters that have historical benefit or potential for unique natural beauty, water quality, aesthetics or recreational capabilities

[5] Trophy Fish—Certain waters are capable of producing large "bragging-size" trout

[6] Problem waters are not defined in the OARS however, according to ODFW personnel, the degraded water quality at Diamond Lake qualifies it as "problem water".

quality and recreational fishery in the long-term[7] under this alternative would be increased with annual implementation of the following contingency plan:

- Annual sampling and tui chub population modeling would occur to facilitate determination of the appropriate level and duration of tui chub removal activities necessary in a given year[8]. Population control measures are more likely to be effective if low numbers of tui chub are maintained. Additionally, low numbers of tui chub must be maintained in order to sustain an improved recreational fishery without exceeding nutrient allocations for water quality.
- Annual stocking with large predacious fish of the size and species determined to be most effective at consuming tui chub would occur.
- Annual mechanical treatments including, but not limited to: netting, seining, trapping, electro shocking, and disruption of spawning would be used to limit tui chub population growth.

Alternative 5 (Modified Rotenone Treatment and Post-Treatment Fish Stocking)

Alternative 5 is the Forest Service's preferred alternative in the FEIS. Alternative 5 was developed to respond to public comments on the Draft Environmental Impact Statement (DEIS) related to the rotenone treatment and the fish stocking strategy. This alternative would rely more on the use of the liquid rotenone formulation and it would target the upper range of recommended rotenone concentrations for use on chub-like species as compared to Alternatives 2 and 3. As such, Alternative 5 is predicted to increase the likelihood that a rotenone treatment would kill 100% of the tui chub present in the lake at the time of treatment. Alternative 5 also reflects the post-treatment fish stocking strategy described by ODFW after publication of the DEIS (Appendix AA – Letter 77 and Appendix D – August 19, 2004, Preliminary Stocking Plans for Diamond Lake for FEIS Alternatives).

Alternative 5 includes all of the following components of the proposed action described in Alternative 2*: canal reconstruction, fall/winter lake drawdown, mechanical fish removal and utilization, non-significant amendment to LRMP, mechanical fish carcass removal and utilization, water management during the lake refill period, monitoring, education, and a tui chub contingency plan*. Connected actions and FEIS Appendix BB activities are also the same as described for Alternative 2. Additionally, Alternative 5 includes the following components:

Modified September Rotenone Treatment: Both powdered (Pro-Noxfish®) and liquid (Noxfish®) formulations of the fish toxicant rotenone would be applied to Diamond Lake in September when water temperature and chemistry reached conditions considered optimal for achieving a complete fish kill (likely in mid September). Under Alternative 5 liquid rotenone would be applied to shallow waters less than about 20 feet in depth. Based on a predicted water volume of 13,300 acre-feet following the drawdown, it is estimated that approximately

[7] For the purpose of alternative comparison over a longer period of time, it is assumed that contingency plans for each alternative would be implemented for five additional years beyond the 7 year project lifetime. Economic estimates for these five years are included as a modification to the economic section of the FEIS.

[8] Monitoring results will be used to determine actual required level of effort. For analysis purposes, during contingency plan implementation, it is assumed that the level of mechanical removal would be reduced by about one third or one month each year during peak spawning. This is based on the assumption that knowledge of chub behavior and preferred habitats would be refined such that a one month effort is adequate to control rate of population growth.

8,900 gallons of liquid rotenone would be used in the lake. The shallow waters of Diamond Lake are dominated by aquatic plants (macrophyte beds) that provide optimal habitat for tui chub. The use of liquid rotenone in these shallow areas was suggested by expert personnel from the California Department of Fish and Game, to increase the likelihood of full chub eradication. The liquid formulation is considered more effective in such environments because it disperses more quickly and thoroughly than the powder form.

Powdered rotenone would be applied to the rest of the lake water, greater than 20 feet. Based on a predicted water volume of 31,000 acre-feet following the drawdown, it its estimated that approximately 168,000 pounds of powdered rotenone would be used in the lake. Powdered rotenone is the recommended formulation for the deeper areas of the lake because it would disperse adequately and is less expensive.
Alternative 5 would treat Silent and Short Creeks exactly the same as Alternatives 2 and 3. All other aspects of rotenone transport, storage, application, and safety management would be the same as described for Alternatives 2 and 3.

Modified Fish Stocking Strategy: Under this alternative, ODFW would restock Diamond Lake with fish following the rotenone treatment as described in Director Lindsay A. Ball's, July 2, 2004 letter (Letter 77 in Appendix AA) and in ODFW's August 19, 2004 memo, "Preliminary Stocking Plans for Diamond Lake for FEIS Alternatives"(Appendix D). The following summarizes ODFW's proposed fish stocking strategy based on a fall 2006 rotenone treatment:

- ODFW would continue to manage for both maintenance and experimental fisheries through 2008, provided a rotenone treatment is successfully completed in 2006.
- ODFW would design and recommend a post-treatment stocking strategy that best meets the goals of the lake based on the following environmental indices described in Eilers (2003a), "An Ecologically-Based Index for Guiding Salmonid-Stocking Decisions in Diamond Lake, Oregon": pH, dissolved oxygen, chlorophyll *a*, phytoplankton biovolume, Sechhi disk transparency, percent rotifers, percent edible zooplankton, and percent amphipods in the zoobenthos.
- Actual stocking numbers could vary based on a number of factors including availability of eggs/fish, facility capacity, actual costs, available funding, monitoring results and management decisions; however, the following describes approximate stocking strategies from 2005 – 2011, based on ODFW's current budget (ODFW 08-19-2004, Memo):

  2005: 24,000 catchable-size trout; 18,000 put-and-take-trout and 3,000 trophy-sized trout;

  2006: 24,000 catchable-size trout (early season only);

  2007[9]: 50,000-100,000 fingerlings and 10,000-25,000 catchable-size predacious trout;

[9] According to ODFW's July 2, 2004 letter and personal communications with Dave Loomis in the years 2007- 2010, it is possible that a minimum of 50,000 put-and-take-size trout would also be stocked in Diamond Lake if sufficient additional funding is secured. However, due to the high level of uncertainty these additional fish were not included in ODFW's subsequent August 19, 2004 memos and thus are not included in the alternative description or elsewhere in the document.

2008[8]: 100,000-200,000 fingerlings and 10,000-25,000 catchable-size predacious trout;

2009[8]: 100,000-300,000 fingerlings and 10,000-25,000 catchable-size predacious trout;

2010-2011[8]: 200,000-300,000 fingerlings and 10,000-25,000 catchable-size predacious trout.

- In compliance with their statutory authority and related policies and plans ODFW would design and implement an ecologically sound stocking strategy. OFWC would enter into a public review of the Diamond Lake Management Plan when sufficient information is available regarding the fishery that can be maintained in the long term. This decision process would take into consideration the environmental, biological, economic, and community values of the people of Oregon.

Under this alternative, by law and by mutual agreement between the USFS, ODFW and ODEQ, applicable nutrient loading allocations provided in ODEQ's pending TMDL publication would be used to determine appropriate numeric goals for annual fish stocking following a rotenone treatment. ODEQ's role and commitment to participate and assist are documented in Letter 78, Appendix AA. In compliance with the TMDL's beneficial uses, appropriate stocking numbers and timing of fingerling size fish releases would not occur post-treatment until zooplankton levels and community composition fall within agreed ranges for supporting water quality recovery and the ecological health of the lake.

BACKGROUND: TOXINS AND WILDLIFE

Because Alternative 1 proposes no active management intervention at Diamond Lake, it is assumed that toxic algae blooms would continue to affect the lake ecosystem and likely worsen in the future. Thus, a general description of the effects of toxic algae blooms on wildlife is documented below. Additionally, because Alternatives 2, 3, and 5 involve treatment of Diamond Lake with the chemical rotenone, a general description of the toxicity of rotenone to wildlife is also included below.

Effects of Toxic Algae Blooms on Wildlife

Introduction

Certain species of blue-green algae produce toxins that in high concentrations (such as during and following major blooms) are harmful to wildlife and humans. Toxic algae blooms are known to have caused death in domestic animals (cattle, pigs, sheep, dogs), waterfowl and other wildlife (Government of Alberta 2003).

The two main types of algal toxins are neurotoxins and hepatotoxins. Neurotoxins affect the nervous system, are fast acting (acting on a timescale of minutes to hours), and can cause death by respiratory failure. Heptatoxins are relatively slow acting (acting on a timescale from hours to days), and attack the liver and other internal organs. Acute (short-term) exposure to high doses of heptatoxins can cause death from liver hemorrhage or from liver failure. Chronic (long-term) exposure to low doses may promote the growth of liver, kidney, and other tumors (MRACC 2002).

In 2001-2003, the blue-green algae *Anabaena flos-aquae*, bloomed in Diamond Lake. This species produces the neurotoxin, anatoxin-a. *Anabaena* was present in sufficient densities that closures to protect human health and safety were implemented at the lake for portions of all three summers. In 2003, *Microcystis aeruginosa,* was also detected in water samples at Diamond Lake. This species produces heptatoxins known as microcystins and nodularin.

Mortality and Illness

Toxic algae blooms have been identified as the cause of mortality for a broad spectrum of species world-wide: a human tragedy in Brazil, an alligator die-off in Florida, domestic livestock kills in Australia, Africa, and South America, and waterfowl and other species in Canada and the United States (Government of Alberta 2002; Wright State University 2003; MRACC 2002; NSW 2002; Burgess 2001). Although standards for human drinking water have been established by the World Health Organization, there are no established toxic thresholds for wildlife species (Creekmore 2001). In general, the amount of toxic water that can kill an animal is usually proportional to the size of the animal. Old, very young, sick or weak animals may have lower tolerance levels and can be poisoned with much smaller amounts (Government of Alberta 2003).

Creekmore (2001), in the Field Manual of Wildlife Diseases, provides a table of documented instances of wild bird mortality caused by algal toxins. The following excerpt is relevant to Diamond Lake (Table 1).

Table 1. Bird mortality from algal toxins.

Toxin	Algal species	Toxin type(s)	Migratory bird species affected	Route of exposure
Cyanobacterial	Microcystis sp., Anabaena sp., Aphanizomenon sp., Nodularia sp., and Oscillatoria	Heptatoxins (mycrocystins and nodularin) Neurotoxins (anatoxin-a and anatoxin –a(s)	Unidentified ducks, geese, and songbirds, Franklin's gull, American coot, mallard, American wigeon	Oral (Water)

Creekmore (2001) also notes that cyanobacterial toxicosis (poisoning) has been suspected in mortalities of free-ranging ducks, geese, eared grebes, gulls, and songbirds. Some symptoms of illness in wildlife exposed to toxins are known from clinical testing. Clinical signs in muscovy ducks dosed with anatoxin-a(s) included excessive salivation, regurgitation of algae, diarrhea, tremors, reduced responsiveness and activity, incoordination, difficult breathing, excessive thirst, wing and leg weakness, and recumbency and intermittent seizures prior to death.

To date, there have been no documented wildlife deaths attributed to toxin exposure at Diamond Lake. However, a recreationist at the lake reported that their dog entered the water during a bloom in July 2003, emerged wobbly and vomited for several hours (Graham 2003).

Toxicity of Rotenone to Wildlife

Introduction

The fish piscicide rotenone is a naturally occurring substance derived from the roots of tropical plants in the bean family. Rotenone is commonly used in fisheries management to eradicate undesirable fish populations. Rotenone kills living organisms by inhibiting a biochemical process at the cellular level making it impossible for the organism to use the

oxygen absorbed into the blood, which is needed in the release of energy during respiration (Finlayson et al. 2000).

Rotenone has the ability to inhibit cellular respiration in fish, mammals, birds, insects, reptiles, amphibians, and even plants. However, at concentrations used in fisheries management, rotenone is only toxic to gill-breathing organisms such as fish, some forms of amphibians and aquatic invertebrates (Bradbury 1986; Finlayson et al. 2000). Studies determined that the reason rotenone is generally toxic to fish, tadpoles, and aquatic invertebrates and not to other animals is that gills provide an efficient mode of entry of the chemical into the cells and the stomach does not (Bradbury 1986; Finlayson et al. 2000).

Finlayson et al. (2000) describe that all animals (including fish) have natural enzymes in the digestive tract that neutralize rotenone, and that the gastrointestinal absorption of rotenone is inefficient. However, gill-breathing organisms are more susceptible to rotenone because rotenone is readily absorbed directly into their blood through their gills (non-oral route) and thus, digestive enzymes cannot neutralize it.

Attachment 2 includes excerpts from two documents detailing the toxicity of rotenone to wildlife (Bradbury 1986; CDFG 1994). These documents include median lethal doses (LD50)[10] of rotenone for birds, mammals, amphibians and reptiles and expected impacts to these species groups as described in scientific literature. Important concepts regarding acute and chronic toxicity detailed in Attachment 2 are summarized below. Most laboratory studies[11] have revealed no evidence of carcinogenic activity and the prevailing scientific opinion is that rotenone does not cause cancer, birth defects, or genetic mutations (USEPA, 1981 and 1989); the Human Health section of this chapter identifies limited exceptions to this conclusion. The primary pathways of exposure to rotenone by wildlife would be oral and dermal (through the skin). Wildlife would have negligible inhalation exposure to rotenone because they would not be in close proximity to the concentrated powder.

Although there are exceptions, normal or routine rotenone treatments in fisheries management generally do not exceed rotenone concentrations of 2ppm. Alternatives 2, 3, and 5 would result in rotenone concentrations of approximately 2 ppm.

No toxicity data or research describing rotenone levels that would sicken animals was found. It is possible that at some large, unquantified, sublethal level of rotenone ingestion, wildlife of any species could become ill and potentially be more vulnerable to predation.

Mammals

Mammals that live near water bodies treated with rotenone may ingest rotenone either by drinking treated water or by eating dead fish that were killed by the rotenone treatment. However, toxicity data for orally administered rotenone indicate that mammals will not be affected by drinking rotenoned water or eating rotenone-killed fish (Bradbury 1986). As described above, the digestive system is not an efficient mode of rotenone entry into an

[10] LD50 or median lethal dosage is the dosage of a toxin that when fed or injected kills 50% of the test animals. It is usually expressed as mg of toxin per kg of the test animal's body weight (Bradbury 1986).

[11] A recent study (Betaret et al. 2000) reported that rats injected with rotenone at 2 to 3 mg/kg body weight each day in the jugular vein for 5 weeks showed symptoms similar to that of Parkinson's disease. Other chemicals were administered with the rotenone to enhance tissue penetration. None of the other studies that used realistic exposure pathways of rotenone have reported such findings. Rotenone entering the body via the actual exposure pathways is unlikely to enter the brain (Rotenone Stewardship Program 2001).

animal's body, thus limiting potential for harm. Rotenone residues in dead fish are generally very low (< 0.1ppm), unstable, and not readily absorbed through the gut of an animal eating a rotenone-killed fish (Finlayson et al. 2000).

As an example: the lowest LD50 of pure rotenone found in the literature on mammals is 55 mg/kg of body weight for guinea pigs. In order for a small mammal weighing approximately ½ pound to be killed by rotenone, it would have to drink 33 gallons of lake water treated with a 2 ppm dosage. (Bradbury 1986).

Chronic toxicity levels are also described in CDFG (1994). The authors conclude that no chronic toxicity affects to mammalian wildlife are expected under a normal rotenone treatment. For example, to exceed the chronic no-effect level, a 22 pound dog would have to regularly consume 10 gallons of water or over 88 pounds of fish per day. Typically, a 22 pound dog would be expected to consume less than 0.5 gallons of water or 2 pounds of fish per day.

Birds

Birds that live near water bodies treated with rotenone may ingest rotenone either by drinking treated water or by eating aquatic invertebrates or fish killed by the rotenone treatment. However, as with mammals, toxicity data indicate that birds will not be affected by ingesting treated water or consuming rotenone-killed organisms (Bradbury 1986).

As an example: a bird weighing ¼ pound would have to drink 25 gallons of treated water or eat more than 40 pounds of fish and invertebrates within 24 hours to receive a lethal dose. This same bird would normally consume 0.2 ounces of water and 0.32 ounces of food daily (Finlayson et al. 2000).

CDFG (1994) documents the chronic no effect level of rotenone for birds at 50 ppm. To exceed this level, a bird would have to consume water containing 50 ppm of rotenone for 30 days or more (Alternatives 2, 3, and 5 would result in rotenone concentrations of approximately 2 ppm).

Amphibians and Reptiles

Toxicity data indicate that amphibians are more tolerant of rotenone than most fish species, nonetheless, rotenone is generally considered toxic to all gill-breathing life stages of amphibians. At concentrations routinely used in fisheries management, rotenone kills frog tadpoles, salamander larvae and gill-breathing adult salamanders. Laboratory tests also indicate that rotenone can impair cell respiration and normal development in amphibian eggs (Bradbury 1986).

Non-gill breathing adult amphibians are much less susceptible to rotenone than larvae. Bradbury (1986) documents that the median lethal concentration (LC50)[12] of rotenone for adult leopard frogs ranged from 3.2 to 7.9 ppm; Alternatives 2, 3, and 5 would result in rotenone concentrations of approximately 2 ppm. At concentrations typically used in fisheries management, CDFG (1994) concludes that rotenone treatment would have little effect on non-gill breathing amphibians. However, Maxell and Hokit (1999) conclude that adult turtles and tailed frog adults are likely to suffer mortality through the application of piscicides.

[12] LC50 or median lethal concentration is the concentration of a toxin in water that kills 50% of the test animals in the water within a specified time (usually 24, 48, or 96 hours). It is usually expressed as ppm (Bradbury 1986).

Inert Ingredients
Liquid formulations of rotenone (i.e. Noxfish®) contain dispersants and emulsifiers known as "inert ingredients". Finlayson et al. (2000) documents that inert ingredients impart no toxicity to fish, insects, birds, or mammals. CDFG (1994) documents the acute toxicity levels of inert ingredients for fish, amphibians, mammals, and birds and concludes that inert ingredients have little, if any effects, to species in typical rotenone applications. Based on this information, it is assumed that inert ingredients would not have added impacts to species beyond those expected for the active ingredient and they will not be discussed as a separate element in the remainder of this section. All potential effects of inert ingredients are included in the documented effects of the rotenone treatment. Toxicity data on inert ingredients is documented in detail in the Human Health section of this chapter.

PETS SPECIES

A pre-field review was performed to determine which Proposed, Threatened, Endangered, and Sensitive (PETS) species are most likely to be impacted by the project. Table 2 summarizes the presence or absence of sensitive species and/or their habitat within or adjacent (in terms of being potentially impacted – e.g. noise) to the actual proposed project area(s). It is based on the latest documented survey and sighting data, scientific literature review and GIS analysis. Impact or effect determinations[13] are based upon this review. If there is a potential impact or effect to the species, further analysis and discussion is provided in the following section. The results of this review are summarized below. Throughout the rest of the Wildlife section the terms discountable and insignificant are used to characterize potential effects. These terms are defined as follows: Insignificant effects relate to the size of the impact and should never reach the scale where "take" occurs. Discountable effects are those extremely unlikely to occur. Based on best judgment, a person would not: (1) be able to meaningfully measure, detect, or evaluate insignificant effects; or (2) expect discountable effects to occur.

The R6 Regional Foresters Sensitive Species list has been updated twice since the preparation of the original Biological Evaluation for this project: once on April 26, 2004 to incorporate some of the species previously known as Survey and Manage Species; and again on July 21, 2004 as a result of new information about a number of species. Table 2 reflects all species currently included on the Sensitive Species List. The following changes have occurred from the original BE: the Canada lynx has been removed from the list; the former Survey and Manage mollusks, Oregon Shoulderband, Chace Sideband, and Crater Lake tightcoil snails have been added to the list; the black swift and Fender's blue butterfly have been added to the list; and the Pacific fisher has been "reclassified" and is now included as a candidate for

[13] Conclusions regarding the consequences of the direct, indirect, and cumulative effects to a Federally listed species or its habitat are defined as: "No effect" – is the appropriate conclusion when a proposed activity will not have any effect on a listed species or critical habitat. "May effect but is not likely to adversely affect" – is the appropriate conclusion when effects on a listed species or critical habitat are expected to be beneficial, discountable, or insignificant. Insignificant effects relate to the size of the impact and should never reach the scale where "take" occurs. Discountable effects are those extremely unlikely to occur. Based on best judgment, a person would not: (1) be able to meaningfully measure, detect, or evaluate insignificant effects; or (2) expect discountable effects to occur. "Is likely to adversely affect" – is the appropriate conclusion if any adverse effect to a listed species or critical habitat is expected to occur as a result of the proposed activities. Conclusions regarding the consequences of impacts to Regional Forester sensitive species are self explanatory: "no impact"; or "beneficial impact"; or "may impact individuals or habitat, but will not likely contribute to a trend towards Federal listing or loss of viability to a population or species"; or "will impact individuals or habitat, and would be expected to contribute to a trend towards Federal listing or loss of viability to a population or species".

listing under the federal Endangered Species Act. Table 2 summarizes the pre-project clearance process that was completed to document and analyze these changes. All applicable Forest Plan standards and guideline for wildlife would be met with this project.

Table 2. Prefield review and biological evaluation summary table.

Common Name	Species Present		Habitat Present		Impact/Effect Expected		Conservation Strategy or Recovery Plan		Loss of Viability or Trend	Comments
	In	Adj.	In	Adj	Species	Habitat	Type	Consistent		
Northern Spotted Owl		✔	✔	✔	YES	NO	NFP	YES	NO	SEE SPECIES DISCUSSION
Bald Eagle	✔	✔	✔	✔	YES	YES	P Bald Eagle RP	YES	NO	SEE SPECIES DISCUSSION
Peregrine Falcon		✔		✔	NO	NO	Pacific Coast RP	YES	NO	The closest falcon eyrie is approximately 11.6 miles northwest of the project area boundary. No impacts are anticipated.
Harlequin Duck		✔	✔	✔	YES	YES	NONE	N/A	NO	SEE SPECIES DISCUSSION
Bufflehead	✔	✔	✔	✔	YES	YES	NONE	N/A	NO	SEE SPECIES DISCUSSION
Yellow Rail			✔	✔	NO	YES	NONE	N/A	NO	SEE SPECIES DISCUSSION
Black Swift					NO	NO	NONE	N/A	NO	No suitable waterfall habitat in project area. Nearest sightings at Lemolo Falls. No impacts anticipated.
Oregon Spotted Frog			✔	✔	NO	YES	NONE	N/A	NO	SEE SPECIES DISCUSSION
Foothill Yellow-legged Frog					NO	NO	NONE	N/A	NO	The project area does not contain suitable habitat for this species. The upper elevation range for this frog is about 1,800 feet (Corkran & Thoms 1993). Species was not detected in Hayes surveys (1997 & 1998). No impacts anticipated
Southern Torrent Salamander					NO	NO	NONE	N/A	NO	The project area does not contain suitable habitat for this species. Hunter (1998) documented the species at 4,800 feet, but the upper elevation range on the Umpqua National Forest appears to be about 3,550 feet (local survey data). Species has not been located on the DL Ranger District. Surveys of the best potential habitat on the District (Copeland and Fish Creeks) occurred in 2002 with no detections. No detections occurred during Hayes surveys (1997, 1998). No impacts anticipated.
Western Pond Turtle					NO	NO	NONE	N/A	NO	The project area does not contain suitable habitat for this species. The upper elevation range for pond turtles in Douglas Co is 3,700 feet & most naturally occurring populations occur below 2,500 feet (T. Farrel, 2003). No historical records occur & species was not detected in Hayes surveys (1997 & 1998). No impacts anticipated.

Common Name	Species Present		Habitat Present		Impact/Effect Expected		Conservation Strategy or Recovery Plan		Loss of Viability or Trend	Comments
	In	Adj.	In	Adj	Species	Habitat	Type	Consistent		
Common Kingsnake					NO	NO	NONE	N/A	NO	The project area does not contain suitable habitat for this species. The upper elevation range for this snake in Oregon is about 1,500 feet (PacifiCorp 1995, Hayes 1996). Species was not detected in Hayes surveys (1997 & 1998). No impacts anticipated.
California Wolverine	✔	✔	✔	✔	YES	NO	NONE	N/A	NO	SEE SPECIES DISCUSSION
Pacific Fisher	✔	✔	✔	✔	YES	NO	Northwest Forest Plan	YES	NO	SEE SPECIES DISCUSSION
Pacific Fringed Myotis	LIKELY	LIKELY	✔	✔	YES	YES	Northwest Forest Plan	YES	NO	SEE SPECIES DISCUSSION
Pacific Pallid Bat					NO	NO	Northwest Forest Plan	N/A	NO	The project area does not contain suitable habitat for this species. Pallid bats are usually associated with desert areas. In Oregon west of the Cascades, the species is restricted to the drier interior valleys of the southern portion of the state (Verts and Carraway 1998). The closest sighting is 50 miles southwest of the project area. No impacts anticipated.
Pacific Shrew	LIKELY	✔	✔	✔	YES	YES	Northwest Forest Plan	YES	NO	SEE SPECIES DISCUSSION
Crater Lake Tightcoil	✔	✔	✔	✔	YES	YES	Northwest Forest Plan	YES	NO	SEE SPECIES DISCUSSION
Oregon Shoulderband					NO	NO	Northwest Forest Plan	YES	NO	Species range not known to extend to the Diamond Lake district. Species not documented during surveys on the district or in the project area. Closest sightings on Tiller RD. No anticipated impacts.
Chace Sideband			✔	✔	NO	NO	Northwest Forest Plan	YES	NO	SEE SPECIES DISCUSSION
Fender's Blue Butterfly					NO	NO	NONE	N/A	NO	Species range not known to extend to the Diamond Lake district. Species is endemic of Willamette Valley. No documented presence on potential habitat in Douglas County. Closest potential habitat on Tiller RD. No anticipated impacts.

Northern Spotted Owl

Large contiguous blocks of nesting, roosting, and foraging habitat NRF[14] habitat are necessary for nesting success and survival of this species. Within the southern Cascades, a 1.2-mile radius circle around an owl nest/activity center represents its home range. Forty percent NRF within 1.2 miles (1,182 acres) is considered the minimum acceptable amount of home range habitat for long-term owl survival. The United States Fish and Wildlife Service (USFWS) utilizes this bench mark to determine if a proposed project will result in an "incidental take" of the species under the Endangered Species Act (ESA). Dispersal habitat[15] for spotted owls satisfies needs for foraging, roosting, and protection from predators. Maintenance of dispersal habitat on a minimum of 50% of federal lands within a given area (e.g., planning area, sub-watershed, quarter-township) is a conventional threshold utilized to evaluate dispersal habitat conditions.

Habitat loss is the primary factor impacting northern spotted owl survivability (Forsman et al. 1984). Non-habitat disturbing activities (e.g., hiking, recreation, etc.) are thought to be relatively insignificant threats (USDI 1995).

AFFECTED ENVIRONMENT

The project area is not located in a CHU or LSR[16]. There are no known spotted owl pairs within 1.0 miles of Diamond Lake proper. The closest known spotted owl to the project area is located approximately 2.1 miles north of Diamond Lake and 0.3 miles west of the Lake Creek project area boundary.

Spotted owl NRF habitat in the vicinity of Diamond Lake was field verified by Forest Service and USFWS biologists. There are 544 acres of NRF habitat within the 7,856 acre project area boundary. There have been no recent surveys for spotted owls within the project area. However, occupancy of these NRF stands by nesting birds is considered unlikely due to elevation and high levels of year-round human use in and closely adjacent to the habitat.

At the landscape scale, a July 2003 USFWS Biological Opinion concluded that the "condition of the Forest's (Umpqua National Forest) LSR's has not changed very much since they were established and habitat exists that should facilitate the movement of spotted owls across the landscape; the landscape should support the conservation and recovery of spotted owls by providing for clusters of reproducing spotted owls and the connnectivity between those clusters" (USDI 2003 pg. 31).

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[14] At high elevations (≥ 4,500 feet), nesting, roosting, and foraging habitat for the spotted owl usually occurs in late successional coniferous forests containing the following habitat features: large snags or large conifer trees (>26 inches d.b.h.) with broken tops, large branches or cavities for nesting; a multi-layered closed canopy that facilitates thermal regulation and protection from predation during roosting; and adequate amounts of dead wood on the forest floor to support populations of prey species (small mammals) for foraging.

[15] Dispersal habitat in high elevation forests is characterized by forests that have a minimum average tree diameter of 9 inches and ≥ 40% canopy cover.

[16] Critical habitats for the spotted owl are mapped areas of land designated by the UF Fish and Wildlife Service to provide protection of spotted owl habitat under the ESA. Any modification of habitat in Critical Habitat Units (CHUs) that may affect either NRF or dispersal habitat must be addressed through consultation. Late Successional Reserves (LSRS) are land allocations under the Northwest Forest Plan that are also designed to provide functional connected habitat for spotted owls at the species range scale.

ENVIRONMENTAL EFFECTS

Direct Effects:
The project area is not located in a CHU; there would be "no effect" to critical habitat under any alternative. None of the alternatives would destroy, degrade or downgrade habitat for spotted owls. Thus, under Alternatives 1-5 there would be "no effect" to habitat.

Alternative 1 would have no direct effects to spotted owls or their habitat.

If spotted owls were nesting in NRF habitat within the project area, there would be potential direct effects to the species associated with some of the proposed activities. Because habitat loss rather than disturbance impacts are believed to be the limiting factor for this species, all potential disturbance impacts are considered to be minor.

Alternatives 2, 3, and 5 would reconstruct the existing canal within the lake and adjacent to Lake Creek. Reconstruction activities would entail staging and utilization of heavy equipment within 0.25 miles of unsurveyed suitable spotted owl habitat during the early (March 1-July 15) and late (July 16-September 30) nesting season for this species. Duration of activities would be four to eight weeks. Additionally, it is possible that equipment associated with boat ramp extensions, connected actions by the Resort, and fish rendering operations could create above ambient noise levels within 0.25 miles of unsurveyed suitable habitat during the breeding season. For purposes of consultation, the United States Fish and Wildlife Service (USFWS) assumes that all unsurveyed suitable spotted owl habitat is occupied and that operation of heavy power equipment in proximity to spotted owls could disrupt their normal reproductive activites (USFWS 2003 Biological Opinion Log # 1-15-03-F-0454). Based on these assumptions, proposed activities described above "may affect and are likely to adversely affect the northern spotted owl".

Under Alternatives 2, 3, and 5 Diamond Lake would be treated with rotenone. Based on information documented under "Toxicity of Rotenone to Wildlife", spotted owls would not be harmed if they ingested rotenone treated water.

Under Alternative 4, it is possible that equipment staging for commercial fish harvesting activities and fish rendering operations could occur within 0.25 miles of unsurveyed suitable habitat at the north end of Diamond Lake during the spotted owl breeding season. Based on the aforementioned USFWS assumptions, these activities could result in a disturbance effect to spotted owls. Thus, this alternative "may affect and is likely to adversely affect the northern spotted owl".

Seasonal restrictions to protect spotted owls during the breeding season are not proposed as mitigation because they would make implementation of action alternatives infeasible.

Indirect Effects:
Alternative 1 perptetuates the existing condition of Diamond Lake; however, due to the this species habits and lack of confirmed presence in the project area, it is not reasonable to assume any risk to spotted owls from ingestion of algal toxins. None of the alternatives impact existing or future spotted owl habitat in the project area. There are no anticipated

existing or future impacts to the owl's prey base associated with any of the alternatives. Thus, there are no expected indirect effects for any alternative.

Cumulative Effects:
Cumulative effects tables (Tables 9-11) document a broad range of past, present, and reasonably foreseeable actions that may contribute to the cumulative effects of land management activities on the spotted owl within the analysis area. None of the action alternatives contribute to the cumulative effect of habitat loss, the primary threat to the species.

Alternative 1 makes no contribution to a cumulative disturbance effect to this species because monitoring that is perpetuated under this alternative would not exceed ambient noise and thus would not be expected to impact spotted owls. Alternatives 2, 3, 4, and 5 represent a potential contribution to a cumulative disturbance effect for the species. However, because spotted owl habitat is limited in the project area, the scale of this potential effect is minor and considered insignificant to the species. Cumulative effects of disturbance activities on spotted owls were recently analyzed at the Forest-wide scale. The USFWS evaluated proposed activities (FY2003-2007) that did not modify habitat, but had a potential disturbance effect on owls; they determined that these activities were not likely to result in jeopardy to the spotted owl (USDI 2003 Biological Opinion Log # 1-15-03-F-0454). Therefore, at the landscape scale no substantive cumulative effects are anticipated.

Conclusions:
Following consideration of the direct, indirect and cumulative effects of the proposed activities, it is determined that:

Alternative 1 would have "no effect" on spotted owls.

Alternatives 2, 3, 4, and 5 would have "no effect" on spotted owl habitat or CHU's, but "may affect and are likely to adversely affect" individual spotted owls through disturbance during the breeding season. There are no meaningful or measureable differences between the action alternatives with respect to potential effects on spotted owls.

Northern Bald Eagle

The bald eagle tends to nest in close proximity to large bodies of water such as lakes, rivers, and large streams. Eagles prey primarily upon fish, but they are also opportunistic feeders that utilize waterfowl, shorebirds, and carrion. Primary habitat components include clean water with abundant populations of fish and large perch trees and roost sites located nearby. Nest and roost trees are often the biggest trees available with stout limbs capable of supporting large nesting structures. Nest trees must also have suitable flight paths into the nest and offer good visibility of the surrounding terrain. The breeding season for the species in Oregon is generally January 1 through August 31.

Bald eagles were placed on the federal Endangered Species list in 1978 due to reduction of numbers caused by DDT and other pesticides in their food supply. The Pacific Bald Eagle Recovery Plan (Recovery Plan) provides guidelines and population goals for muliple management zones (Recovery Zones) within the seven state Pacific Recovery Region (Recovery Region) - Oregon, Washington, California, Idaho, Nevada, Montana, and Wyoming (USDI 1986).

Supplemental Feeding Programs: Supplemental feeding programs for bald eagles have been used as mitigation for prey loss resulting from rotenone treatments at other lakes in Oregon (Kaiser 2004, Popp and Isaacs 1989). For this project under Alternatives 2, 3, and 5, the USFWS would require implementation of a supplemental eagle feeding program at Diamond Lake. Previous studies of bald eagle behavior during supplemental feeding indicate that supplied food is readily used by eagles in the absence of natural prey (Kaiser 2004, Popp and Isaacs 1989, Marr 1988). A supplemental feeding program at Hyatt Lake near Ashland, Oregon was considered to be successful; nesting eagles fledged 1 young in 1990 following an October 1989 rotenone treatment (Kaiser 2004). Data was inconclusive for a study of eagle productivity following a rotenone treatment at Thompson Reservoir; eagles failed in their nesting attempt during supplemental feeding, however, the birds had a poor reproductive record historically (fledging only three young from 1979 – 1988). In both cases, eagles did not abandon their nest site and returned to normal feeding behavior at the termination of the supplemental feeding.

Studies associated with supplemental feeding programs (Popp and Isaacs 1989, Marr 1988), report use of feeding stations by primarily diurnal avian scavengers – gulls, ravens, and turkey vultures. No mammals were observed using feeding stations at Thompson Reservoir.

Multiple techniques were used during the supplemental feeding program at Hyatt Lake to limit scavenging by other wildlife including: placing food items just before daylight to minimize loss of supplemental feed to nocturnal scavengers; utilizing large intact fish carcasses to reduce use of supplemental feed by non-target avian predators (ravens, crows, gulls, and turkey vultures); and removal of unconsumed carcass parts from the feeding station the day after feeding. Ravens and gulls were the only scavengers documented during this effort (Kaiser 2004). It is possible that at Diamond Lake mammalian scavengers such as coyotes and raccoons would also utilize supplemental food sources on occasion.

AFFECTED ENVIRONMENT

There are two eagle nest sites at Diamond Lake – the Rocky Point and Silent Creek sites. Over 20 years of annual reproductive survey data exists for each of these sites. Reproductive history by decade is summarized in Table 3 below.

Table 3. Reproductive History of Bald Eagle Nest Sites at Diamond Lake.

Site Name	Time Period	Young Fledged
ROCKY POINT	1982-1989	**1 Total** (1 in 1987)
	1990-1999	**4 Total** (1 in 1992) (2 in 1994) (1 in 1995)
	2000-2004	**6 Total** (1 in 2001) (2 in 2002) (2* in 2003) (1 in 2004)

Site Name	Time Period	Young Fledged
SILENT CREEK	1981-1989	**4 Total** (1 in 1981) (1 in 1982) (1 in 1985) (1 in 1986)
	1990-1999	**6 Total** (1 in 1990) (? in 1991) (1 in 1994) (2 in 1995) (1 in 1998) (1 in 1999)
	2000-2004	**6 Total** (2 in 2000) (1* in 2001) (2 in 2002) (1 in 2004)

* = young assumed fledged, but not actually observed flying.

The Rocky Point bald eagle nest was first discovered in 1982. Reproductive success appears to have increased steadily over time at this site. The nest was active in 2003 and the birds successfully fledged two young. The nest was also active in 2004 and one young was fledged. The Silent Creek nest was first discovered in 1981. Reproductive success also apears to be on a postive trend at this site. In 2003, the nest was active but no young were fledged; however, in 2004, one young was fledged.

Historic midwinter bald eagle surveys provide sporadic documentation of winter-time eagle presence at Diamond Lake over the past decade. However, it is likely that eagles use the lake year round. According to eagle expert Frank Isaacs, the nesting eagles are generally on territory at Diamond Lake by January. Diamond Lake freezes in most winters by early December so foraging opportunities at the lake are limited to areas of open water around the Short and Silent Creek inlet and Lake Creek outlet. Diamond Lake eagles probably go downstream to forage until ice-off which usually occurs from late March to early May. Nesting activities proceed from winter through spring and summer. Young eagles likely remain at Diamond Lake until late fall (Pers. comm. Frank Isaacs).

There are two additional eagle nests in the broader analysis area for this project. There is one eagle nest at Lemolo Lake and one at Toketee Lake. Eagles are known to use these lakes year-round. At the landscape scale, available information indicates that bald eagle populations are increasing range-wide. In the Pacific Recovery Region, the number of occupied territories has consistently increased since 1986. Eagle productivity goals for the Recovery Region have been met since 1990, but distribution and nesting goals for some Recovery Zones within the Recovery Region have not been met (USDI 2003).

In Oregon, for the 1998 - 2002 time period, the state-wide population, distribution, and productivity goals were met. Eight out of ten Recovery Zones met or exceeded their population goals and thus attained the 80% distribution level identified in the Recovery Plan. The state-wide average for productivity exceeded the goal of 1.0 young fledged per pair (Pers. comm. Frank Isaacs).

The project area is located within the California/Oregon Coast Recovery Zone (#13). During the 1998-2002 time period, all Recovery Plan goals for this zone were met. The population goal for Recovery Zone #13 is 45 occupied territories; in 2002 there were 83 occupied territories. The productivity goal is 1.0 young fledged per pair; from 1998-2002, the five year average productivity rate was 1.07 (Pers. comm. Frank Isaacs).

ENVIRONMENTAL EFFECTS

Direct Effects:
Alternative 1 would have no direct effects to bald eagles because no habitat or disturbance impacts are expected to occur.

Alternatives 2, 3, and 5 propose multiple activities that would potentially directly affect bald eagles at Diamond Lake throughout the lifetime of the project. Canal reconstruction activities would occur within line of sight of the Rocky Point eagle nest and in-lake activities would occur in areas utilized as foraging habitat by the pair. These activities would likely occur in late spring or summer during the bald eagle breeding season and thus represent a potential disturbance impact. However, this is considered to be a discountable effect to the species because bald eagles at Diamond Lake have adapted to high levels of year-round human use and continue to reproduce successfully; based on this information, it is considered unlikely that this potential disturbance effect would actually occur.

The proposed draw down respresents a short-term beneficial effect to bald eagles at Diamond Lake because fish would be concentrated into a smaller area and readily accessible to the birds. However, subsequent mechanical fish removal activities would reduce the availability of prey and potentially disrupt normal foraging activites for both nesting eagle pairs. Mechanical harvest activities would likely occur late in the breeding season when young eagles are about to fledge. These activities are not expected to hinder reproductive success because an adequate prey base would likely remain in Diamond Lake (or downstream) and eagles would not be expected to abandon their young at this stage in the breeding season.

Rotenone treatment would occur after the bald eagle breeding season, but eagles would still be present at the lake. Eagles would be expected to ingest rotenone treated water and consume rotenone killed fish. However, as described in the "Toxicity of Rotenone to Wildlife" section of this chapter, eagles are not expected to be harmed. Because the rotenone treatment is designed to kill all of the fish, this activity would effectively eliminate the primary prey base for bald eagles at Diamond Lake for an extended period of time. Because it would occur after young eagles have fledged (and likely dispersed), loss of prey base in late fall would not compromise eagle reproductive success in the year of chemical treatment. Eagles normally utilizing Diamond Lake in the late fall to early winter season could be displaced to adjacent water bodies downstream or east of the Cascades.

The Rocky Point and Silent Creek eagle pairs would be expected to be on territory by the January following chemical treatment and would likely attempt to nest as usual (Pers. comm., Frank Isaacs). Under normal circumstances, nesting bald eagles probably routinely forage in adjacent/downstream habitat until ice-off at Diamond Lake in the spring. Lack of available fish prey base at Diamond Lake in the late spring and summer when fish are normally abundant at the lake, and eagles are feeding themselves and their young, represents the greatest potential adverse affect associated with these alternatives. Although eagles would not be expected to abandon their nests, lack of a fish prey base could compromise

nesting success (Pers. comm., Frank Isaacs).

Because timing of proposed restocking of Diamond Lake with fish would be based on ecological indices of lake health (i.e. when the biota in the lake has recovered adequately to support fish without compromising water quality), it is not possible to state unequivocably when the eagle prey base would be restored. However, for this analysis, it is assumed that Diamond Lake would not be stocked with many fish in the first spring/summer following the chemical treatment, but would be stocked to a greater extent in the following spring/summer. Based on this assumption, bald eagle nesting success would be compromised for one to two breeding seasons.

For Alternatives 2, 3, and 5, a supplemental feeding program would be implemented as mitigation to reduce potential effects to nesting bald eagles associated with the short-term loss of their fish prey base. Site-specific details of the supplemental feeding program will be developed as follows, per the terms and conditions included in the USFWS Biological Opinion # 1-15-04-F-0240: "Within 6 months of the date of signing the Diamond Lake Restoration EIS Record of Decision, the Forest shall conduct joint meetings between Forest biological staff, the Oregon Department of Fish and Wildlife and this Office pursuant to development and adoption of a supplemental feeding program for the bald eagle pairs expected to nest at Diamond Lake during the entire period the fish prey base is depressed. The Forest shall ensure this feeding plan is finalized and its implementation fully funded prior to the use of rotenone in Diamond Lake. Adequate supplemental feeding must be conducted in a manner to maintain the current bald eagle population for as long as the prey base is depressed."

Fish restocking under Alternatives 2, 3, and 5 would restore the eagle prey base at Diamond Lake and thus beneficially affect eagles. Alternative 3 would be expected to provide a higher number or larger prey items more quickly than Alternatives 2 and 5 because Alternative 3 proposes stocking with legal-sized fish while Alternatives 2 and 5 utilize a primarily fingerling-based stocking strategy. None of the other activities proposed under these alternatives nor the connected actions associated with them have consequential effects to the bald eagle or its habitat.

Alternative 4 would utilize commercial fish operations for approximately two months in June and July and one month in September on an annual basis to harvest tui chub from Diamond Lake. Commercial fishing activities represent a potential disturbance affect to eagles during the breeding season. However, as discussed earlier, it is considered unlikely that these additional activities would actually disturb eagles given the existing high levels of human activity at the lake. This represents a discountable effect to the species. Commercial fishing would also reduce the available prey base for eagles. These activities are not expected to hinder reproductive success because an adequate prey base would likely remain in Diamond Lake throughout the lifetime of the project[17]. This is considered to be an insignificant effect to the species.

Given that consultation with the USFSW has occurred, Wildlife Standard and Guideline #9 (LRMP-37) has been met.

[17] In the FEIS, the "lifetime of the project" is a seven year time period.

Indirect Effects:
Alternative 1 perpetuates the existing condition, forgoes the opportunity to address declining water quality and thus leaves eagles vulnerable to exposure to toxic algae blooms in the future. Under this alternative, it is possible that eagles would become ill or die from ingestion of water containing algal toxins during or following a summer bloom.

Alternatives 2, 3, and 5 could result in increased use of Lemolo and Toketee Lakes by the Diamond Lake eagles during the time when the fish prey base is absent or limited at Diamond Lake. As a result, the Lemolo and Toketee eagles and winter migrant eagles could experience a temporary increased competition for prey. This potential effect is considered insignificant because the downstream prey base is likely adequate to support the additional foraging pressure and the supplemental feeding mitigation would reduce the dependence of the Diamond Lake eagles on downstream forage.

Under Alternative 4, it is expected that annual commercial fishing operations would be needed beyond the lifetime of this project to control the tui chub population. Thus, potential disturbance effects and prey base effects described above would be expected to continue in the future. As documented above, these potential effects are considered discountable and insignificant, respectively. Similarly, implementation of a contingency plan for Alternatives 2, 3, and 5, would extend potential disturbance and prey base effects into the future, but are also considered to be discountable and insignificant.

Cumulative Effects:
Past, present, and future management activities that entail fish stocking and development near Diamond and Lemolo Lakes and the North Umpqua River are the primary management activities of relevance to bald eagles in the analysis area (Tables 9-11). Additionally implementation of contingency plans as reasonably forseeable management activities associated with these alternatives would also contribute to cumulative effects for the species.

Alternatives 2, 3, 4, and 5 represent a potential contribution to cumulative disturbance and prey base effects to bald eagles. However, the consequences of these potential cumulative effects are considered to be insignificant to the species for all alternatives because it is expected that under a worse case scenario, the bald eagles at Diamond Lake would fail to successfully reproduce for one to two breeding seasons; given the positive status of the bald eagle population within Recovery Zone #13 and State-wide, this temporary lack of recruitment would not be considered a threat to the continued recovery of the bald eagle. Alternative 1 contributes to the cumulative effects in that it maintains the existing condition and leaves eagles vulnerable to exposure to algal toxins.

Conclusions:
Alternative 1 represents the greatest sustained risk to bald eagles at Diamond Lake over time. Alternatives 2, 3, and 5 have greater potential short-term adverse effects than Alternative 4 but may have a higher potential for achieving and maintaining long-term habitat improvement through improved water quality and prey base than Alternatives 1 or 4 (See Water Quality Sections for details). However, it is also acknowledged that under Alternatives 2, 3, and 5, at some unknown point in the future, if tui chub remain or if/when they are reintroduced and contingency plans fail, adverse impacts similar to current water quality problems would be expected to recur. There are no meaningful or measurable differences between Alternatives 2, 3, and 5.

Following consideration of the direct, indirect and cumulative effects of the proposed activities, it is determined that:

> Alternative 1 "may affect and is likely to adversely affect" bald eagles through perpetuation of eagle exposure to toxic algae blooms.
>
> Alternatives 2, 3, and 5, as mitigated, "may affect and are likely to adversely affect" bald eagles through temporary substantial reductions in available prey base and potential effects on reproductive success.
>
> Alternative 4, "may affect, but is not likely to adversely affect" bald eagles by insignificant reductions in prey base and discountable potential disturbance effects.

Harlequin Duck

Harlequins are sea ducks which migrate inland to breed in the mountains. They prefer large, rocky, swift streams or rivers, generally with many down trees, out-washed root wads, and similar debris about the edges of the stream course. Nest locations are adjacent to rapids or other turbulent water. The species feeds mainly on animal matter including mollusks, crustaceans, insects and fish. Typical first observations of this duck in mountain streams occur between March to April while nesting occurs from May to early June. The males return to the coast after the egg clutch is completed, but the female and brood will remain in the stream/river system until late September. In North America, their numbers appear to be declining as a result of habitat loss, oil spills and disturbance to nesting ducks by humans (Turbak 1999). However, at a state-wide scale it is difficult to determine population trends because historic population numbers are unknown.

AFFECTED ENVIRONMENT

There are no known sitings of harlequin ducks within the project area. The closest observation of this species is approximately 8.9 miles west of the project area boundary on the North Umpqua River. Lake Creek represents low quality potential habitat for this species within the project area. Surveys for harlequins were conducted according to protocol on Lake Creek on May 27 and August 6, 2003. No harlequin ducks were detected.

Portions of the North Umpqua River that occur within the larger project analysis area are also known habitat for the harlequin duck. There are eleven recent (1985 to present) observations of harlequins along the North Umpqua River (and its tributaries) during the breeding season.

At the landscape scale, a 1993 comprehensive survey effort for harlequin ducks in Northwest Oregon identified 47 breeding pairs (Thompson et al. 1993); however, due to survey techniques, this is probably an underestimate of the breeding population in the area (Dowlan 1996).

ENVIRONMENTAL EFFECTS

Direct Impacts:
Based on lack of detections during recent surveys, lack of historical observations and low quality of potential habitat for harlequin ducks within the project area, it is considered

unlikely that harlequins would be utilizing Lake Creek during the lifetime of this project. However, because the species is known to occur on the Forest, it is reasonable to assume species presence for purposes of full disclosure.

Alternative 1 would have no anticipated direct impacts to harlequin ducks because it does not propose activities on Lake Creek.

Alternatives 2, 3, and 5 propose multiple activities that could potentially impact harlequins and their habitat. Canal reconstruction activities adjacent to Lake Creek have the potential to disturb individual ducks or broods, if ducks were utilizing the area during implementation. Draw down of the lake would temporarily change potential habitat conditions in Lake Creek by increasing the flow. This would have minor habitat impacts because high flows would temporarily degrade macroinvertebrate prey habitat (see Fish and Streams sections for details). This impact is probably best characterized as a neutral impact to the species because harlequins would be utilizing their coastal winter habitat during the majority of the draw down period (late September to late March).

The temporary dewatering of Lake Creek during the rotenone treatment and subsequent low flows during the lake refill period (described in detail in the Streams section), would eliminate potential habitat for harlequins on portions of the stream in the short-term. Potential Lake Creek habitat would likely be unuseable by harlequin ducks for one breeding season due to lack of flow and macroinvertebrate prey base. This potential impact is considered to be minor because of the availability of other higher quality habitat in the watershed and the low liklihood that harlequins actually breed on Lake Creek.

No rotenone treatment is planned for Lake Creek and as described above, the creek would be dewatered during lake treatment. Thus, harlequin ducks would not be expected to ingest rotenone treated water or prey items; if they did, no adverse impacts would be expected (see "Toxicity of Rotenone to Wildlife" section). Proposed monitoring represents a minor, potential disturbance impact, if harlequin ducks were utilizing Lake Creek during monitoring activities; this is considered to be an insignificant and discountable impact. None of the other activities proposed under these alternative nor the connected actions associated with them have consequential impacts to harlequins or their habitat.
Alternative 4 would only potentially impact harlequin ducks through proposed monitoring activities. Monitoring is an occasional activity, and represents a temporary and minor disturbance impact to the species. This is considered to be an insignificant and discountable impact.

Indirect Impacts:
Alternative 1 perpetuates ongoing monitoring activities and thus, represents a minor, potential disturbance impact to the species. Because harlequins are not expected to use Diamond Lake, risk of exposure to algal toxins is considered to be neglible.

None of the alternatives are expected to impact harlequin ducks or their habitat downstream of the project area (beyond Lake Creek) based on the following rationale. Aternative 1 would maintain the existing condition. Under Alternatives 2, 3, and 5, rotenone treated water would be confined to Diamond Lake and thus, no downstream impacts to the harlequin prey base are anticipated. The water flow contribution of Lake Creek is a small percentage of the total North Umpqua River system flow, thus manipulations of this flow under Alternatives 2, 3, and 5 would not be expected to change habitat conditions for harlequins on the North Umpqua

River. Under Alternative 4, all proposed activities are confined to Diamond Lake and would essentially maintain the existing condition downstream.

Alternatives 1 and 4 would perpetuate the existing condition and would not be expected to change the quality of potential harlequin habitat in Lake Creek in the future. Based on conclusions drawn by the Project Hydrologist, changes in Lake Creek associated with Alternatives 2, 3, and 5 would be short-term and not expected to substantially change the future habitat conditions. It is expected that sustained high flows would create additional habitat complexity in Lake Creek over time (deep pools) that would benefit macroinvertebrate prey for harlequins. Subsequently, pools would fill in and a return to baseline levels of macroinvertebrates would occur. This represents a minor benefit or neutral impact to future harlequin habitat on Lake Creek.

Cumulative Impacts:
Cumulative effects Tables 9-11 document a broad range of past, present, and reasonably foreseeable actions that contribute to the cumulative effect of land management activities on the harlequin duck within the analysis area. Activities that manipulate historic stream flow regimes and result in increased human activity in proximity to stream habitat are contributors to a cumulative habitat loss and disturbance effect. Of note are past activities such as the construction of Highway 138 and the installation of PacifiCorp operations that affected harlequin duck habitat on the North Umpqua corridor; past, present, and future water quality monitoring efforts on Lake Creek and implementation of water rights at Diamond Lake within the project area; and presumed increases in recreational use on the North Umpqua River in the future.

Alternatives 2, 3, and 5 represent a minor potential contribution to the cumulative disturbance and habitat impacts on the species. Alternatives 1 and 4 only contribute to the cumulative effects in that they maintain the existing condition.

The majority of known and suspected breeding habitat for harlequin ducks within the analysis area and on the Forest is contained in the Wild and Scenic North Umpqua River corridor that spans from Soda Springs Dam down to Rock Creek. According to the North Umpqua River Watershed Analysis (USDA April 2001, V.2) only an estimated 12% of the riparian habitat within this 33.8 mile stretch of the river has been converted from forest into paved roads, gravel roads, residential areas and other facilities. No future timber harvest and little future development is expected in this area. Additionally, tributaries to the North Umpqua River corridor that also contain harlequin habitat are protected under the NWFP through standard and guidelines for Riparian Reserves. Thus, availability of suitable habitat for harlequin ducks is not considered to be a limiting factor for the species and cumulative impacts are considered to be minor.

Conclusions:
Alternatives 2, 3, and 5 have a greater potential to impact harlequin ducks than Alternatives 1 and 4. However, impacts to the species are considered to be minor under all alternatives.

Following consideration of the direct, indirect and cumulative impacts of the proposed activities, it is determined that:

> Alternatives 1 - 5 "may impact individuals or habitat, but are not likely to contribute to a trend toward federal listing or loss of viability of the species".

Bufflehead

Buffleheads are small "diving ducks" that can be found on small ponds to large lakes, and larger streams and rivers. They breed and nest in tree cavities in coniferous-deciduous woodland near lakes and ponds. In freshwater, these ducks feed on aquatic insects, snails, amphipods (small crustaceans), small fish and some aquatic vegetation (American Ornithologists' Union 1983).

AFFECTED ENVIRONMENT

Buffleheads are known to occur at Diamond Lake. They are considered to be an uncommon to fairly common spring migrant and an abundant fall migrant. They have been documented in small numbers during the summer at the sewage ponds and South Shore meadow area during Audubon Society surveys in 1996-2002. Buffleheads nested at the sewage ponds adjacent to Diamond Lake in 1989 and 1990 (Fix 1990).

According to Fix (1990) this species begins to arrive in numbers during October, peaking in early - to mid November. They tend to concentrate at the south end of the lake, but individuals and small groups may be seen anywhere on the lake in the fall months. They winter on Toketee Lake, and likely on other area lakes that do not completely freeze. Fix (1990) estimated that a maximum of approximately 1,000 buffleheads utilized Diamond Lake during early November of 1988 and 1989.

At the landscape scale, buffleheads are considered to be a common spring and fall migrant in Oregon. Marshall et al. (2003) describes the species as possibly the most ubiquitous diving duck in western Oregon during the late fall through early spring. However, the breeding population is considered sensitive by ODFW because of small size and limited nesting habitat.

ENVIRONMENTAL EFFECTS

Direct Impacts:
Alternative 1 would have no anticipated direct impacts on buffleheads.

Alternatives 2, 3, and 5 have potential impacts on both individuals and habitat of this species. Survey data during the 1996-2002 breeding seasons document only one observation of a single bufflehead on Diamond Lake proper near the South Shore meadows on 6/26/99 (Umpqua Valley Audubon database). Based on this information, spring and summer activities on Diamond Lake and Lake Creek (i.e., canal reconstruction, mechanical fish harvests, etc.) would not be expected to impact buffleheads.

Buffleheads would likely be present on Diamond Lake in small numbers during the September rotenone treatment proposed under Alternatives 2, 3, and 5. As described in the "Toxicity of Rotenone to Wildlife" section of this document, buffleheads are not expected to be harmed as a result of ingesting water or consuming dead prey. However, in the months of October and November when buffleheads are present in large numbers, rotenone treatment would substantially reduce available prey items in Diamond Lake for fall migrants of this species. The majority of migrating buffleheads would likely be displaced to the Klamath Basin, further along on their southern migration route (Pers. comm. Ron *Maertz*). This represents a potential adverse impact to both individuals and habitat. Because the duration of the impacts

are short-term (one to two fall seasons), other suitable habitat is available to displaced birds and no deaths are expected to occur, consequences of this displacement effect to the species would not be expected to result in a loss of species viability or a trend toward Federal listing. None of the other activities proposed under these alternatives nor the connected actions associated with them have consequential impacts to buffleheads or their habitat.

Alternative 4 would have minor potential impacts to buffleheads. Proposed commercial fish harvesting operations occuring annually in the month of September have the potential to disturb a small number of buffleheads that might be using Diamond Lake proper at this time. It is also possible that individuals could be harmed by becoming entangled in a gill net. To mitigate this potential impact, to the greatest extent practical, net operators would be required to disentangle and free birds that become entangled in fishing nets.Other proposed activities would occur in the spring and summer and would not be expected to impact the species.

Indirect Impacts:
Alternative 1 perpetuates the existing condition, forgoes the opportunity to address declining water quality and thus leaves buffleheads vulnerable to exposure to toxic algae blooms in the future. Under this alternative, it is possible that buffleheads would become ill or die from ingestion of water containing algal toxins during or following a summer bloom (see Effects of Algal Toxins on Wildlife section). Alternative 1 would also indirectly impact this species by perpetuating lake conditions that support a limited and declining future population of aquatic macroinvertebrates (see Fisheries report for details).

Alternatives 2, 3, and 5 would be expected to result in a beneficial impact to the species by facilitating the return of a more abundant and diverse aquatic macroinvertebrate prey base for the species in the near future (beginning one or two years following rotenone treatment) when the lake recovers (see Fisheries section for details).

Impacts to the abundance and diversity of the future prey base for buffleheads at Diamond Lake are less certain under Alternative 4 due to the fact that only a portion of the tui chub population would be removed and tui chub are very effective predators on macroinvertebrates. However, it is assumed that some positive impacts would be realized (see Fisheries section for details).

Cumulative Impacts:
As documented above, concern for this species in Oregon is focused on the breeding population. Lack of suitable nesting cavities and high levels of human disturbance during the breeding season are considered to be the primary limiting factors for buffleheads in the state (Marshall et al. 2003). Sewage ponds where the species has nested (one pair) would not be impacted by the project. There is no documented breeding by buffleheads on Diamond Lake proper. Thus, none of the alternatives are expected to impact breeding buffleheads or nesting habitat. Based on this information, in combination with the knowledge that buffleheads are one of the most common fall migrants in western Oregon, potential cumulative effects associated with the proposed activities from this project considered in the context of all activities documented in the cumulative effects[18] Tables 9-11 would not be expected to result in a loss of species viability or a trend toward Federal listing.

[18] Includes consideration of implementing contingency plans as reasonably forseeable actions associated with action alternatives.

Conclusions:
Alternative 1 represents the greatest sustained risk to buffleheads at Diamond Lake over time through exposure to algal toxins. Alternatives 2, 3, and 5 have greater potential short-term adverse impacts than Alternative 4, but may have a higher potential for achieving and maintaining long-term habitat improvement through improved water quality and prey base than Alternatives 1 or 4 (See Water Quality Sections for details). There are no meaningful or measureable differences between Alternatives 2, 3, and 5.

Following consideration of the direct, indirect and cumulative impacts of the proposed activities, it is determined that:

> Alternatives 1 - 5 "may impact individuals or habitat, but are not likely to contribute to a trend toward federal listing or loss of viability of the species".

Yellow Rail

Yellow rails are secretive birds that inhabit shallowly flooded sedge meadows at 4,100- 5,000 feet in elevation. The yellow rail mainly breeds east of the Rocky Mountains in the northern United States and southern Canada. However, there is an isolated population in the Klamath Basin in south-central Oregon (Popper and Stern 1996). The majority of yellow rails in Oregon and the more optimal habitats occur at the Klamath National Wildlife Refuge and on BLM and Forest Service Lands (Winema National Forest) in the Fourmile Creek and Jack Spring areas. Lundsten and Popper (2002) estimate that there are 235-285 breeding pairs in Oregon.

AFFECTED ENVIRONMENT

There are no historic or recent sitings of yellow rails within the project area or on the Umpqua National Forest. The closest observation of this species is approximately 12 miles northeast of the project area at Big Marsh on the Deschutes National Forest.

Limited, low quality potential habitat for the species exists within the project area in the Silent Creek marshes at the southern end of Diamond Lake. Surveys for yellow rails were conducted according to protocol on June 26 and July 7, 2003. No yellow rails were detected. At a landscape scale, the Oregon yellow rail population is generally considered stable because the majority of the population is located on federally-owned lands and birds are protected during the breeding season. However, because of the small size and limited distribution of the yellow rail state-wide, the birds are still considered at risk (Pers. comm. Ken Popper 2003).

ENVIRONMENTAL EFFECTS

Direct, Indirect, and Cumulative Impacts:
Based on lack of historic occurrence anywhere on the Forest, lack of detections during recent surveys in the project area, and limited quantity and quality of potential habitat within the project area, it is not reasonable to assume that yellow rails would be present within the project area during the lifetime of this project. Thus, no direct, indirect, or cumulative impacts to individual yellow rails are expected under any of the proposed alternatives.

Alternatives 1 and 4 would have no direct, indirect or cumulative impacts to yellow rail habitat because both alternatives would effectively maintain and perpetuate the existing condition of habitat for the species.

Alternatives 2, 3, and 5 propose a draw down that would temporarily dewater the Silent Creek marshes adjacent to Diamond Lake. Drying of the marshes would degrade the quality of potential yellow rail habitat in the short-term. Because existing potential habitat is considered to be of no meaningful benefit to the species, and because the majority of the southwest Oregon population is protected during the breeding season, potential direct, indirect, and cumulative impacts associated with these alternatives are considered insignificant to the species. None of the other activities proposed under these alternative nor the connected actions associated with them have consequential impacts to yellow rails or their habitat.

Conclusions:
Potential impacts to yellow rails are considered to be minor under all alternatives. Alternatives 2, 3, and 5 have temporary habitat impacts and there is no meaningful or measureable differences between the three.

Following consideration of the direct, indirect and cumulative impacts of the proposed activities, it is determined that:

> Alternatives 1 and 4 would have "no impact" on the yellow rail.
>
> Alternatives 2, 3, and 5 "may impact individuals or habitat, but are not likely to contribute to a trend toward federal listing or loss of viability of the species."

Oregon Spotted Frog

The spotted frog is nearly always found in or near a perennial water body such as a spring, pond, lake or sluggish stream. The species is most often associated with nonwoody wetland plant communities (species such as sedges, rushes, and grasses) (Leonard, et al. 1993). The introduction of exotic species (i.e. bullfrogs and non-native fish species) and urban development are believed to be the primary causes of their population decline (there are no bull frogs in Diamond Lake). Although high elevation lakes in the Cascades are potential habitat for this species, spotted frogs have never been recorded in Douglas County.

AFFECTED ENVIRONMENT

Diamond Lake contains very low quality potential habitat for the Oregon spotted frog; this species is not known or expected to occur in the project area. The species was not detected in Diamond Lake, Horse or Teal Lakes or Lake Creek during formal surveys by Hayes in 1996 and 1997. No documented historical records occur in or near the project area. According to Hayes (Pers. comm. 2003) all valid records of Oregon spotted frogs occurring south of Willamette Pass in Oregon are located in the Klamath Basin. Oregon spotted frogs only cross the Cascade Mountain crest north of Williamette Pass where the crest is lower, reflecting a biogeographic pattern repeated by several species. The liklihood of occupancy of Diamond Lake by spotted frogs is considered to be very low to none (Pers. comm. Marc Hayes). The closest observation of this species is a large population approximately 12 miles northeast of the project area at Big Marsh on the Deschutes National Forest.

ENVIRONMENTAL EFFECTS

Direct, Indirect, and Cumulative Impacts:
Based on lack of historic occurrence anywhere on the Forest or in Douglas County, lack of detections during recent surveys in the project area, and the opinion of Herpetologist Marc Hayes, it is not reasonable to assume that spotted frogs would be present within the project area during the lifetime of this project. Thus, no direct, indirect, or cumulative impacts to individual spotted frogs are expected under any of the proposed alternatives.

Alternative 1 perpetuates degraded water quality and prey conditions in Diamond Lake, but as described for Alternatives 2 - 5 below, because the habitat is not expected to be occupied by spotted frogs now or in the future, this is considered to be a discountable and insignificant impact.
Activities associated with Alternatives 2, 3, and 5 that modify conditions in and around Diamond Lake would degrade potential habitat in the short-term. Fish stocking under all alternatives represents an adverse affect to potential habitat. Although Alternatives 2-5 are expected to improve the future prey base, overall quality of habitat would not be expected to improve due to the continued presence of predatory fish. Because existing potential habitat is considered to be of no meaningful benefit to the species, and because it is considered unlikely that potential habitat would ever be naturally occupied by the species due the topographic barriers described above, the potential direct, indirect, and cumulative impacts associated with these alternatives are considered to be both insignificant and discountable. The connected actions associated with these alternatives have no consequential impacts to spotted frogs or their habitat.

Conclusions:
Potential impacts to spotted frogs are considered to be minor under all alternatives. Alternatives 1-5 have potential habitat impacts. There is no meaningful difference between these alternatives.

Following consideration of the direct, indirect and cumulative impacts of the proposed activities, it is determined that:

> Alternatives 1-5 "may impact individuals or habitat, but are not likely to contribute to a trend toward federal listing or loss of viability of the species."

California Wolverine

Wolverines are the largest member of the mustelid (weasel) family and are considered to be one of the rarest mammals in North America (Ruggiero et al. 1994). In the western United States, its distribution extends as far south as California, where it is listed as "threatened" and Colorado (listed as "endangered"). It is generally associated with remote, sparsely inhabited, high elevation subalpine and alpine forests at elevations ranging from 6,000 feet to above timberline. They have large home ranges (39 to 351 square miles) and travel long distances (commonly 18-25 miles) in daily hunting. Wolverines tend to avoid human developments and extensive human settlements and major access routes may function as dispersal barriers for this species (Ruggiero et al. 1994). A carnivore, the wolverine will eat almost anything it can catch, but is thought to primarily be a scavenger and feeds on large

mammal carrion, especially in the winter months. Highest densities of this species occur in areas with low human activity and adequate year-round food supplies. Females den in caves, rock crevices, or hollow logs and are susceptible to disturbance while denning.

AFFECTED ENVIRONMENT

There are two historic sightings of wolverine within the project area boundary, one in 1956 and one in 1971. Potential denning habitat for the species is located 2.7 miles east of the project area in the Mount Thielsen Wilderness. There is a 1995 wolverine sighting adjacent to this potential denning habitat.

Helicopter surveys conducted in 1997 by ODFW and the USFS located tracks and a potential wolverine den within the Wilderness, 4.8 miles northeast of the project area. However, as surveyors gained additional on-the-ground experience at track and den identification, they began to question the validity of this sighting; they now have a low level of confidence in the sighting and believe the tracks seen were likely American marten (Pers. comm., Raymond J. Davis).

Helicopter surveys for wolverine have occurred for four consecutive winters (2001-2004) in the Mt. Theilsen and Sky Lakes Wilderness areas (south of Crater Lake). No confirmed wolverine tracks or dens were located during these surveys. Additional surveys are planned for the next two years.

Although it is possible that the project area could lie within the home range of one or more wolverines, habitat effectiveness for this species is greatly reduced by the year-round, high levels of human use at and adjacent to Diamond Lake. In general, wolverine would be expected to avoid the project area rather than utilize it as habitat.

Ruggiero et al. (1994) documents 23 records of wolverine in Oregon from 1981-1992 compared with 57 records from 1913-1980 and describes the current status in the state as unknown. The USFWS was recently petitioned to list the wolverine as threatened or endangered in the lower 48 states of the United States. The October 21, 2003 USFWS finding (68 FR 60112) concludes that the petition and other available information did not present substantial scientific or commercial information indicating that listing the wolverine in the contiguous United States may be warranted.

ENVIRONMENTAL EFFECTS

Direct Impacts:
Alternative 1 would have no anticipated direct impacts on wolverines or their habitat because no activity would occur. None of the action alternatives would impact denning habitat or be expected to disturb denning wolverines. Increased levels of human use represent the only potential impact that warrants discussion.

High levels of human use reduce habitat effectiveness for wolverine. Existing high levels of year-round human use adjacent to Diamond Lake reduce the liklihood that wolverine would utilize this area even if it was contained in a wolverine home range. However, because the species has been documented in the project area, potential impacts are described for purposes of full disclosure.

Under Alternatives 2, 3, 4, and 5 implementation of the majority of the proposed activities (including the connected actions) would result in increased levels of human use in and around Diamond Lake. If a wolverine attempted to approach Diamond Lake during the lifetime of the project, these activities in combination with existing ambient noises levels, would be expected to compel the animal to avoid the area. This potential habitat effectiveness and disturbance impact is considered to be insignificant (immeasureable) and discountable (unlikely to occur).

Indirect Impacts:
Alternative 1 would only be expected to impact wolverine by perpetuating water qualitiy monitoring on Lake Creek. Increased human activity associated with monitoring would have the potential to temporarily displace any individuals that might be using the area. As described above, this potential disturbance impact is considered to be iinsignificant and discountable. Risk of exposure to algal toxins is considered to be neglible.

Alternatives 2, 3, 4, and 5 are all designed to improve water quality and the recreational fishery at Diamond Lake. If successful, it is reasonable to assume that human use in the spring/summer/fall would increase in the future as a result of implementation. As such, all of the action alternatives would further reduce the effectiveness of the forest surrounding Diamond Lake as suitable habitat for wolverines.

Cumulative Impacts:
Past activities that resulted in the development of Diamond Lake as a high use, year-round recreation area led to habitat conditions that limit use of the project area by wolverines. Increased human use resulting from Alternatives 1, 2, 3, 4, and 5, and ongoing and future management activities in the area (including implementation of contingency plans) represent a minor contribution to the cumulative effect of reduced habitat effectiveness for this species.

Due to the existing levels of human development and recreational use, the lack of denning habitat in the project area, and the lack of documented den sites during the recent surveys of the adjacent Mt. Thielsen Wilderness, the potential cumulative effect of reduced habitat effectiveness is considered to be insignificant to the species.

Conclusions:
Potential impacts to wolverine are considered to be minor under all alternatives. Alternatives 1-5 have the potential to reduce habitat effectiveness through increased human use. There are no meaningful differences between the potential impacts of these alternatives on this species.

Following consideration of the direct, indirect and cumulative impacts of the proposed activities, it is determined that:

> Alternatives 1, 2, 3, 4 and 5 "may impact individuals or habitat, but are not likely to contribute to a trend toward federal listing or loss of viability of the species."

Pacific Fisher

A medium-sized member of the weasel family, the fisher is associated with low to mid-elevation (<4,000 ft.) late-successional/old growth forests in western Oregon; they are also closely associated with forested riparian areas, which they use for foraging, resting and as travel corridors (Heinemeyer and Jones 1994). Within late-successional forests, large snags and trees (≥20 inches d.b.h.) with hollows or cavities are important structures for maternal den sites (Thomas et al. 1993). The fisher is primarily a carnivore and its diet consists mostly of small mammals (e.g., rodents, shrews, squirrels, hares, porcupine and beaver), birds and carrion. Forest stands with high levels of coarse woody debris are thought to be good habitat for prey.

Human activities (such as trapping and poisoning) have resulted in the apparent extirpation of fishers throughout much of their historical range in the Pacific states. Populations of fishers in Oregon are restricted to two disjunct and genetically isolated populations in the southwestern portion of the state: one in the southern Cascade Range and one in the northern Siskiyou Mountains. The population in the southern Cascade Range was reintroduced and is descended from fishers that were translocated to Oregon from British Columbia and Minnesota between 1961-1981 (Aubrey and Lewis, 2003). Because of the isolation and long distances between populations, Aubrey and Lewis (2003) conclude that the historical continuity in fisher distribution that once provided for genetic interchange among fisher populations in the Pacific states no longer exists.

AFFECTED ENVIRONMENT

There are no known fisher den sites within or adjacent to the project area. There is a documented 1993 sighting of a fisher near the southern project area boundary adjacent to Silent Creek. There is also a reliable 1996 fisher sighting approximately 2.7 miles west of Lake Creek. Although the majority of the project area is higher elevation than is normally utilized by this species, it is considered to be potential habitat. Based on the elevation and habitat preferences it is expected the project area would be used by dispersing fishers.

At the landscape scale, the southern Cascade Range population of fishers is located approximately 18 miles southwest of the project area boundary. On April 8, 2004 the USFWS published a notice in the Federal Register detailing their finding that the West Coast population of fisher is a distinct population that has been added to their candidate species list (69 FR 18770).

ENVIRONMENTAL EFFECTS

Direct Impacts:
None of the alternatives would reduce available den sites for fisher and none of the alternatives would be expected to disturb denning individuals.

Alternatives 1 and 4 would only impact fisher through ongoing and proposed water quality monitoring on Lake Creek. Increased human activity associated with monitoring would have the potential to temporarily displace any individuals that might be using the area. Due to the rarity of the species, it is considered unlikely that this potential impact would actually occur. If it did occur, it would be inconsequential to the species.

Alternatives 2, 3, and 5 have the potential to impact fisher habitat through the temporary dewatering of portions of Lake Creek and the temporary drying of wetlands adjacent to Silent Creek. Because of their use of forested riparian areas the temporary dewatering of portions of Lake Creek and drying of wetlands around Silent Creek could reduce the suitability of this habitat for some fisher prey species. Consequences of this potential impact are considered to be minor, due to the limited scale of this impact relative to the availability of suitable habitat and prey in proximity to the project area. Potential monitoring impacts would be the same as described above for Alternatives 1 and 4. None of the other activities proposed under these alternatives, nor the connected actions associated with them have consequential impacts to fisher or their habitat.

Indirect Impacts:
Alternative 1 would only be expected to impact fisher by perpetuating water quality monitoring on Lake Creek. Increased human activity associated with monitoring would have the potential to temporarily displace any individuals that might be using the area. As described above, this potential disturbance impact is considered to be insignificant and discountable. Risk of exposure to algal toxins is considered to be neglible for this species.

None of the alternatives would impact future fisher habitat in the project area. There are no anticipated impacts to the fisher's future prey base associated with any of the alternatives.

Cumulative Impacts:
Direct mortality from trapping and predator control efforts and habitat loss from timber harvest and human development led to the extirpation of fisher throughout much of its historical range in the Pacific States (Aubrey and Lewis, 2003). Past, present, and future activities that fragment late-successional habitat (timber harvest and road building), remove coarse woody debris (fuels reduction projects), and develop riparian areas (campgrounds etc.) are considered to be the primary activities that contribute to the potential cumulative impacts of land management on fishers in the analysis area (Tables 9-11)

Alternatives 2, 3, and 5 represent a short-term, minor contribution to the cumulative habitat impact and Alternatives 1, 2, 3, 4, and 5 represent an inconsequential contribution to a disturbance impact for this species. The high elevation and existing levels of human development in the analysis area limit its potential importance to fisher. There are no documented fisher den sites anywhere on the Forest. The ongoing and future management activities in the analysis area would occur primarily in existing developed areas. Based on this information, the potential cumulative impacts to fisher are considered insignificant to the species.

Conclusions:
Potential impacts to fisher are considered to be minor under all alternatives. Alternatives 2, 3, and 5 have a higher potential to impact the species than Alternatives 1 and 4. Alternatives 1 and 4 would only impact the species through increased human use in potential habitat.

Following consideration of the direct, indirect and cumulative impacts of the proposed activities, it is determined that:

> Alternatives 1, 2, 3, 4 and 5 "may impact individuals or habitat, but are not likely to contribute to a trend toward federal listing or loss of viability of the species."

Pacific Fringed Myotis

This bat is usually described as a cave-dwelling bat (Verts and Carraway 1998, Cristy and West 1993), but are also known to roost in rock crevices, bridges, buildings, large trees and snags (Cross et al. 1996, Weller and Zabel 2001). They mate from September to February and females form maternity colonies of up to several hundred individuals, which are usually in caves, but may occur in large hollow trees (Pat Ormsbee, pers. com.).

Weller and Zabel (2001) documented that habitat use by this species is influenced by the availability of large (>12 inch d.b.h.), tall snags for roosting. Roosts tend to be near stream channels (Weller and Zabel 2001), which are used for travel and foraging corridors, and also occur in portions of stands that have lower canopy closures. This species of bat uses multiple trees or snags as roost sites (Weller and Zabel 2001) and have been documented to use up to five different sites during an 18 day period (Cross et al. 1996).

Fringed myotis commonly feed on insects along forest edges and stream corridors; beetles, moths, and spiders make up a large portion (approximately 94%) of their diet (Verts and Carraway 1998). The species is believed to migrate in the fall, but little is known about the magnitude of movements or the migratory destination (O'Farrell and Studier 1980).

The following ecological information about the fringed myotis bat is relevant: (1) young bats are generally fledged and indistinguisable from adults by August; (2) female bats are adding fat during the late summer and early fall to prepare for hibernation; (3) females and young would likely have permanently left the maternal colony by September; (4) fringed myotis bats probably migrate to lower elevations in the fall and are likely hibernating by November; and (5) the majority of their prey items are terrestrial rather than aquatic insects (Verts and Carraway 1998, O'Farrell and Studier 1980).

AFFECTED ENVIRONMENT

There are ten documented occurrences of Pacific fringed myotis on or near the Umpqua National Forest. There are no documented observations of the species within the project area. However, the area contains suitable habitat; it is likely that they do occur, and species presence is assumed. The closest sighting of this species is a 1983 observation of a single bat roosting under a bridge, 14.3 miles to the west of the project area.

At a landscape scale, there is a strong concern that loss of snags and large decadent trees from the widespread conversion of old-growth forests to young, even-aged plantations in this region has significantly reduced the availability of potential roosts for this and other bats in the Pacific Northwest (USDA/USDI 1994 – Appendix J2-49).

ENVIRONMENTAL EFFECTS

Direct Impacts:
Alternatives 1 and 4 would have no direct impacts on this bat because neither alternative would impact individuals or habitat.

Alternatives 2, 3, and 5 have potential impacts on both individuals and habitat of this species. These alternatives would dewater portions of Lake Creek for approximately 2 months in the late fall (mid September – mid November). These alternatives also propose a rotenone

treatment that would eliminate most aquatic insects from Diamond Lake in about mid September. There is too little data on the migration habits of this species to determine whether the bats would have migrated to lower elevations by mid September; however, for purposes of full disclosure, it is assumed that some fringed bats would still be utilizing the project area for foraging during the fall season. Based on these assumptions, dewatering of Lake Creek would temporarily degrade habitat for the species through the removal of drinking water and aquatic prey items along portions of the stream. Consequences of this potential impact are considered to be minor, due to the limited scale of this impact relative to the availability of suitable habitat downstream on Lake Creek and availability of terrestrial prey in and adjacent to the project area.

Bats utilizing Diamond Lake during and after the mid September rotenone treatment would be exposed to rotenone treated water. As described in the "Toxicity of Rotenone to Wildlife" section of this document, bats (mammals) are not expected to be harmed as a result of ingesting water or consuming dead prey. Removal of aquatic insects represents the greatest potential impact to fringed bats associated with these alternatives. Consequences of this impact are considered insignificant to the species because fringed bats tend to prey heavily on terrestrial insects, young of the year would already be fledged, and there is available foraging habitat adjacent to the project area, if bats were temporarily displaced as a result of the lack of aquatic prey. Fringed bats would not be present at the lake during the late fall, winter, or early spring. The aquatic prey base would begin recovery in the spring/summer following rotenone treatment, but the population would still be expected to be lower than the existing population. Thus, bats would likely still be reliant on terrestrial prey and adjacent habitat to supplement the limited aquatic prey base during the summer to fall season following treatment. These impacts to the aquatic prey base are expected to have insignificant consequences to the population of fringed myotis bats (Pers. comm., Dr. John Hayes, Pat Ormsbee). None of the other activities proposed under these alternatives nor the connected actions associated with them have consequential impacts to fringed myotis bats or their habitat.

Indirect Impacts:
Because aquatic insects are not the primary prey for this species, all of the potential impacts to prey are considered to be minor.

Alternative 1 would indirectly impact this species by perpetuating lake conditions that support a limited and declining future population of aquatic insects (see Fish section). It is also possible that bats would be harmed or killed by ingesting algal toxins during or following a bloom.

Alternatives 2, 3, and 5 would be expected to result in an indirect beneficial impact to the species by facilitating the return of a more abundant and diverse aquatic prey base for the species in the future when the lake recovers (see Fisheries section for details). If tui chub remain following a rotenone treatment or if/when they are reintroduced in the future, associated declines in aquatic prey would again be expected.

Impacts to the abundance and diversity of the future aquatic prey base for fringed myotis bats at Diamond Lake are less certain under Alternative 4 due to the fact that only a portion of the tui chub population would be removed and tui chub are very effective predators on aquatic macroinvertebrates. However, it is assumed that some positive impacts to aquatic prey would be realized (see Fish section).

Cumulative Impacts:
Loss of available large snag habitat across the landscape is considered to be the primary limiting factor for this species. Potential past, present, and future activities that remove large snags and late-successional habitat (i.e. timber harvest, hazard tree removal, human developments) are considered to be the primary activities that contribute to the potential cumulative impacts of land management on fringed bats in the analysis area (Tables 9-11)

None of the alternatives would remove large snags or trees from the project area; thus none contribute significantly to the cumulative impacts to this species. With the exception of hazard tree removal in developed areas around Diamond Lake, little loss of snag habitat within the project area is expected in the future. The project area is bounded by Mt. Bailey Roadless Area to the west, Mt. Thielsen Wilderness to the east, and Crater Lake National Park to the south; due to the management objectives of these areas, little loss of large snag or late-successional habitat is expected on the majority of lands adjacent to project area. Protection of Riparian Reserves would also limit future habitat impacts to the north. Based on this information, the potential cumulative impacts to fringed bats are considered insignificant to the species under all alternatives.

Conclusions:
Alternative 1 represents the greatest sustained risk to the fringed myotis bat over time through perpetuation of toxic algae blooms. Alternatives 2, 3, and 5 have greater potential short-term adverse impacts than Alternative 4, but may have a higher potential for achieving and maintaining long-term habitat improvement through improved water quality and prey base than Alternatives 1 or 4 (See Water Quality Sections for details).There are no meaningful or measureable differences between Alternatives 2, 3, and 5.

Following consideration of the direct, indirect and cumulative impacts of the proposed activities, it is determined that:

> Alternatives 1, 2, 3, 4 and 5 "may impact individuals or habitat, but are not likely to contribute to a trend toward federal listing or loss of viability of the species."

Pacific Shrew

One of the largest shrews the Pacific shrew is found in humid forests, marshes, and thickets and is considered a riparian species (Gomez and Anthony 1998); however, it has been found as far as 20 meters away from stream banks (Anthony et al. 1987). It is more commonly found in early-successional forests and less often in late-successional stands. It requires down logs, brushy thickets, or ground debris for cover and feeding. Prey items include snails, slugs, centipedes, insect larvae, earthworms and some vegetable matter. Nests are made of dry grass or leaves and are placed in a stump or down log.

AFFECTED ENVIRONMENT

There are no known observations of the Pacific shrew in the project area. However, the project area is considered to be suitable habitat and species presence is assumed (surveys were not conducted nor recommended for this species because of the high incidence of shrew mortality associated with known survey methods). The closest observation of the species is approximately 3.6 miles southwest of the project area in a DEMO Unit at Watson Falls.

Recent surveys indicate that the Pacific shrew is well-distributed on the Umpqua National Forest. There are 31 documented observations of the shrew on the Forest and they occur on all four Ranger Districts.

ENVIRONMENTAL EFFECTS

Direct Impacts:
Alternatives 1 and 4 would have no direct impacts to the species because no habitat alteration or other activities that would potentially harm individuals would occur.

Alternatives 2, 3, and 5 have the potential to impact shrews and their habitat through the temporary dewatering of portions of Lake Creek and the temporary drying of wetlands adjacent to Silent Creek. These activites could reduce the suitability of this habitat for some shrew prey species in the short-term. As a result, it is possible that individual shrews could be temporarily displaced or compelled to forage over wider areas during this time. A number of factors would likely mitigate the consequences and extent of this potential impact: moisture-retaining microrefugia (down logs and clumps of senescent vegetation at the base of shrubs and trees) adjacent to the creek and within the wetlands would be expected to support a number of prey species; fall and winter precipitation would serve to add and retain moisture in the impacted area for much of the time; and adjacent suitable habitat and prey would be available to support the species. Thus, potential impacts are believed insignificant to the species. None of the other activities proposed under these alternatives nor the connected actions associated with them have consequential impacts to shrews or their habitat.

Indirect Impacts:
Alternative 1 perpetuates the existing condition of water quality at Diamond Lake and thus perpetuates toxic algae blooms. It is possible that shrews could be harmed or killed by ingesting algal toxins in Diamond Lake. The liklihood of shrews frequently watering in Diamond Lake proper is considered to be very low.

There are no anticipated indirect impacts associated with any of the other alternatives because none of the alternatives are expected to modify the condition of future habitat for the species.

Cumulative Impacts:
Past, present, and future activities (i.e. fuels reduction and human developments in riparian habitat) that remove vegetation and down woody debris from suitable undeveloped riparian habitats are considered to be the primary activities that contribute to the potential cumulative impacts of land management on Pacific shrews in the analysis area (Tables 9-11)

Alternatives 2, 3, and 5 represent a short-term, limited-scale contribution to the cumulative habitat impact for this species because of the potential impacts to prey species. Death of individuals would not be expected as a result of proposed activities. Alternative 1 represents a minor risk to individuals of this species because of potential ingestion of algal toxins. Recent surveys on the Umpqua National Forest indicate that the species may actually be locally common. Little manipulation within undeveloped ripararian habitat is expected in the future within the analysis area. Based on all of the above, the potential cumulative impact is not considered significant to the species under any alternative.

Conclusions:
Alternatives 2, 3, and 5 have temporary habitat impacts to Pacific shrews and there is no meaningful or measureable differences between these alternatives. Alternative 1 represents a perceived low risk to the species through exposure to algal toxins.

Following consideration of the direct, indirect and cumulative impacts of the proposed activities, it is determined that:

> Alternatives 1, 2, 3, and 5 "may impact individuals or habitat, but are not likely to contribute to a trend toward federal listing or loss of viability of the species."
>
> Alternative 4 would have "no impact" on the Pacific shrew.

FORMER SURVEY & MANAGE SPECIES

When the original Biological Evaluation for this project was written, the Forest Plan required protection of certain late-successional wildlife species, which may not have been fully protected by other standards and guidelines, when they occur outside of LSR's or Riparian Reserves. Additional amendments to the Northwest Forest Plan redefined Survey and Manage categories based on new information and species characteristics (USDA/USDI 2001). On April 21, 2004, the Northwest Forest Plan (NWFP) was amended to remove Survey and Manage mitigations. As part of the analysis conducted to amend the NWFP, all 296 Survey and Manage species were reviewed by Special Status Species Program Managers to determine if they warranted inclusion in Agency Special Status Species Programs. Based on that review, 152 of the 296 Survey and Manage species were eligible for inclusion in one or more of the Agencies' existing Special Status Species Programs.

In brief, for Survey and Manage wildlife that occur on the Umpqua National Forest, and potentially occur within the project area, this review and Record of Decision concluded the following: red tree vole does not meet criteria for Sensitive species in this part of Oregon; great gray owl does not meet criteria for Sensitive species in Oregon; Crater Lake tightcoil, Oregon Shoulderband, and Chace Sideband snails do meet criteria for Sensitive species in this area.

Conservation of former survey and manage species now rely on other elements of the Northwest Forest Plan and the Forest Service Sensitive Species Policies. The objectives of which are to avoid actions which may contribute to the need to list a Sensitive Species under the Endangered Species Act and to help maintain the diversity and viability of species on Forest Service managed lands.

Known sites of species formerly included in Survey and Manage that are now included in the Sensitive Species Program will continue to be managed under the policies of the Sensitive Species Program. For Survey and Manage species not included in Sensitive Species Programs, known sites were released for other management uses after the effective date of the Record of Decision.

The Oregon Shoulderband snail is not expected to occur in the planning area (see Table 2 prefield review). There are no anticipated impacts to this species. As described in the DEIS, regardless of status, surveys were not required or recommended for the red tree vole because

proposed activities are not habitat disturbing activities that have the potential to cause a significant negative effect on the species habitat or the persistence of the species at the site (Survey Protocol for the Red Tree Vole, V. 2.1, 2002). These two species will not be further analyzed.

A discussion of the potential impacts of the project to the great gray owl is retained for purposes of full disclosure. It remains in this section to facilitate tracking between Draft and Final EIS. Similarly, discussions of the Crater Lake tightcoil and Chace sideband, now Sensitive Species, are kept separate from other Sensitive species for tracking purposes between Draft and Final.

Great Gray Owl

This owl is one of the largest owls in North America. It nests in late-successional forests (>60% canopy closure), but forages in early-successional habitat (e.g., meadows, clearcuts). Within the range of the northern spotted owl, it is most common in lodgepole pine forests adjacent to meadows, but is also found in other coniferous forest types. Great gray owls in Oregon prey most often on voles and pocket gophers (Marshall et al. 2003). Although little is known about the existing population numbers or changes in numbers over time, it is believed that populations of great gray owls in this state may have declined in recent years due to habitat loss resulting from harvest of old-growth forests as well as urban sprawl in Deschutes County (Marshall et al. 2003).

AFFECTED ENVIRONMENT

There are no confirmed great gray owl nests in or adjacent to the project area. The closest documented nest site for the species is approximately 6.5 miles to the west. Silent Creek and Kelsay Valley wetlands, as well as scattered riparian meadows along Lake Creek are potential foraging habitat for great gray owls within or closely adjacent to the project area.

Protocol surveys are not required for this project because there are no ground disturbing activities proposed in great gray owl nesting habitat (USDA/USDI Survey Protocol 1995 revised 1997). However, multiple surveys have been conducted for great gray owls in and adjacent to the Diamond Lake area in recent years. Multi-visit surveys were conducted in the Lemolo Lake/Lake Creek area in 1994, 1996, 1997, 1998, and 2003. Several detections of great gray owls were made within and closely adjacent to the project area, near the mouth of Lake Creek, during August of 1994. Nighttime auditory responses were received from an adult female (1996), an adult male (1998), and a juvenile (2003) during these separate survey efforts in the vicinity of Lemolo Lake and lower Lake Creek. Anecdotal sightings of great gray owls in the same general area are also documented from 1979 and 1983. Based on the above information, it is assumed that great gray owls utilize meadows within and adjacent to the project area for foraging and possibly nest in surrounding forests.

ENVIRONMENTAL EFFECTS

Direct, Indirect, and Cumulative Impacts:
None of the alternatives would remove or degrade potential nesting habitat for great gray owls. Therefore, no direct, indirect, or cumulative effects to nesting habitat would occur.

Alternatives 1 and 4 would have no anticipated impact on great gray owls or their habitat; the risk of great gray owls consuming algal toxins is neglible.

Alternatives 2, 3, and 5 have the potential to temporarily modify foraging habitat in a neutral or beneficial manner. Primary prey items for great gray owls (pocket gophers and voles) occupy meadow habitats adjacent to forests. Most of these animals utilize ground burrows and would not use areas that were so wet that burrows would collapse or become filled with water. The temporary dewatering of Lake Creek would not be expected to result in a noticeable drying affect on meadows adjacent to Lake Creek that are downstream from its confluence with Theilsen Creek. Thus, in areas where great gray owls are known to forage, these alternatives would be expected to have a neutral impact on prey habitat. The draw down of Diamond Lake is expected to result in the temporary drying of the wet meadows at the south end of the lake. Drying of areas that are normally inundated with water would improve habitat for voles and pocket gophers and thus could indirectly benefit great gray owls in the short-term. When considered in the context of past, present, and reasonable foreseeable activities in the area (Tables 9-11), because these alternatives do not modify nesting habitat and the scale and duration of the neutral or beneficial impact is limited, potential cumulative impacts are considered to be inconsequencial to the species. None of the other activities proposed under theres alternatives nor the connected actions associated with them have consequential impacts to great gray owls or their habitat.

Conclusions:
Following consideration of the direct, indirect and cumulative impacts of the proposed activities, it is determined that:

> Alternatives 1 and 4 would have no impact on great gray owls.
>
> Alternatives 2, 3, and 5 would have neutral or beneficial impacts on individuals or habitat in the short-term. There is no difference between the alternatives' potential impacts to the species.

Crater Lake Tightcoil Snail *(Sensitive Species)*

This tiny snail may be found in perennially wet situations in mature conifer forests, among rushes, mosses, and other surface vegetation or under rocks and woody debris within 33 feet of open water in wetlands, springs, seeps, and riparian areas, generally in areas which remain under snow for long periods in the winter. Riparian habitats in the Eastern Oregon Cascades may be limited to the extent of permanent surface moisture, which is often much less than 33 feet from open water (USDA/USDIa 2003).

AFFECTED ENVIRONMENT

Wetland habitat in the Diamond Lake project area is potential habitat for this species. Two survey visits for the Crater Lake tightcoil were conducted within suitable habitat in the project area in 2003. This species was documented at five locations within the planning area adjacent to Lake Creek. Additional potential habitat for this species exists within the same 6th field watershed.

Distribution of the Crater Lake tightcoil sites along Lake Creek is as follows: three sites are located below the confluence with Thielsen Creek (sites 7, 8, 26); one site is located near two

small tributaries that would not be influenced by the draw down (site 18); and one site is located before the Thielsen Creek confluence with no tributary influence (site 16).

The Crater Lake tightcoil has been located at several locations on the Diamond Lake Ranger District in springs and wetland habitat types. Numerous individuals (greater than 20) were located at the Crystal Springs site approximately 1.8 miles from the project area.

The Crater Lake tightcoil was formerly categorized as a Category A^2 Survey and Mange species (USDA/USDI 2003b). Species in this category, were considered rare, required pre-disturbance surveys, and required management of known sites.

The Management Recommendation for the Crater Lake tightcoil that is relevant to this project is:

> Avoid activities that would lower the water table at the site, thus reducing soil moisture below that required by the species, or possibly altering vegetative communities (USDA/USDI 1999).

The January 2001 ROD for Amendments to the Survey and Manage, Protection Buffer, and other Mitigation Measures Standards and Guidelines(USDA/USDI 2001) allowed occasional exemptions to the manage all known sites requirement as documented below:

> Professional judgement, coupled with locally specific information and advice from taxa specialists about the species, may be used to identify occasional sites not needed for persistence. These exceptions will be reviewed by the REO (S&G's pg. 8).

ENVIRONMENTAL EFFECTS

Direct, Indirect, and Cumulative Impacts:
Alternatives 1 and 4 would have no impact on the Crater Lake tightcoil because they do not propose activities that would alter habitat or potentially harm individuals.

Alternatives 2, 3, and 5 have potential impacts on individuals and habitat of this species. Under these alternatives, portions of Lake Creek between Diamond Lake and the confluence of Lake Creek and Thielsen Creek would be effectively dewatered for the time period beginning around the middle of September and ending in approximately early November. Subsequently, this same section of Lake Creek would be maintained at low flows until late spring or early summer (see Stream section for details). For the portions of Lake Creek extending from the Thielsen Creek confluence to Lemolo Lake, Lake Creek's flow would be approximately 15-20% of normal seasonal flow during the period of no outflow from Diamond Lake, and would then increase for the winter to spring/summer period when a minimum of 10 cfs of water would be allowed to exit Diamond Lake.

According to the project Hydrologist and Groundwater specialist, it is expected that sites 7, 8,18, and 26 would experience minor changes in the ground water and limited changes in the soil moisture. The microclimate ranges tolerated by these snails is not known, so it is not possible to confidently conclude that the draw down would have no impact on the species at this site. However, other mitigating factors include rain and snow which would be contributing moisture to these sites during much of the draw down period, and moisture-

holding microsites such as down logs and riparian vegetation which would remain intact and available for snails and/or eggs.

It is expected that site 16 would experience major changes in the groundwater and corresponding changes in the soil moisture. Thus, it is possible that snails or eggs could become dessicated at this site. Natural mitigating factors (precipitation and microhabitats) would also be available at this site.

In summary, Alternatives 2, 3, and 5 would result in an unquantified level of temporary habitat degradation; minor in four areas and more substantial in one area. It is possible that snail or egg survival could be negatively impacted by the dewatering of Lake Creek, particularly at site 16. Because so little is known about the microclimate tolerances of this species, pre- and post- draw down monitoring of soil moisture and species presence would occur. To reduce the consequences of potential loss of individual snails or eggs, translocation of some individuals from the Crystal Springs sites would occur if post-project surveys result in absence of the species at any of the sites listed above.

Additional spot surveys of suitable habitat in proximity to the project area are also planned to assess prevalence and distribution of the species in the watershed.

Conclusions:
Alternatives 1 and 4 would have no impact on the Crater Lake tightcoil.

Alternatives 2, 3, and 5 "may impact individuals or habitat, but are not likely to contribute to a trend toward federal listing or loss of viability of the species." Consultation with Nancy Duncan, Regional Mollusk Taxa Lead has occurred; Duncan reviewed the project and concluded that these alternatives, as mitigated, would not affect persistence of the species (Duncan 2004). On 02-17-04, the Interagency Survey and Manage Group[19] responsible for approving exemptions on survey and manage issues, reviewed the project, concurred with Duncan's determination, and exempted the Forest from the manage known site requirements for this project (Huff 2004).

Chace Sideband *(Sensitive Species)*

Habitat for this snail is usually found within 98 feet of rocky areas, talus deposits and in associated riparian areas in the Klamath physiograph province and adjacent portions of the southwestern Oregon Cascades. Areas of herbaceous vegetation in these rocky landscapes adjacent to forested habitats are preferred habitat. Moist, shaded rock surfaces are preferred for daily refuges. In more mesic, forested habitats, especially in the Oregon Cascades, the species is associated with large woody debris and the typical rocky habitat is not required. Forest habitats without either rock features or large woody debris are not currently considered to be suitable habitat for this species (USDA/USDIa 2003).

AFFECTED ENVIRONMENT

This snail is not known to occur within the project area or anywhere on the Diamond Lake Ranger District. The species does occur and appears to be fairly common in suitable habitat

[19] The Interagency Survey and Manage Group is the entity that has the authority to approve exemptions to survey and manage management guidelines. They are the current Regional Ecosystem Office (REO) representatives.

on the adjacent Tiller Ranger District. The closest sighting of this species is 17 miles southwest of the project area boundary. The Diamond Lake project area contains a very limited amount of low quality habitat for the species. Two survey visits for the Chace sideband were conducted within suitable habitat in the project area in 2003. This species was not detected during surveys.

ENVIRONMENTAL EFFECTS

Direct, Indirect, and Cumulative Impacts:
The project area does not occur within the known range of the species and surveys did not detect the species within the project area. There are no anticipated impacts associated with this project.

Conclusions:
Alternatives 1, 2, 3, 4, and 5 would have no impact on the Chace sideband snail.

MANAGEMENT INDICATOR SPECIES

The Umpqua National Forest Land and Resource Management Plan (1990) identifies the following species/groups as Management Indicator Species (MIS) for the Forest: northern spotted owl, pileated woodpecker, marten, bald eagle, peregrine falcon, Roosevelt Elk, blacktail deer, and cavity nesters. The bald eagle, peregrine falcon, and northern spotted owl were addressed in the PETS section of this chapter. Marten are addressed under "Other Mammals" below.

None of these alternatives would modify habitat (snags) for pileated woodpeckers and cavity nesters. There are no anticipated negative impacts to these species or habitat associated with this project and thus they will not be discussed further.

Deer and elk are known to utilize the project area. None of the alternatives would degrade habitat for these species. However, deer and elk likely utilize Diamond Lake as drinking water and thus, there are potential impacts to individuals.

Alternative 1 forgoes the opportunity to address declining water quality and leaves deer and elk vulnerable to exposure to toxic algae blooms. As documented in the "Effects of Toxic Algae Blooms on Wildlife" section of this document, algal toxins are known to cause mortality in mammals. Because deer and elk are expected to consume relatively large quantities of water during the summer months, it is anticipated that some individuals may become ill or die from ingestion of water containing algal toxins during or following a summer bloom at some point in the future. Because area deer and elk populations are large, impacts would not be expected to lead to a trend toward Federal listing or cause a loss of viability of these species.

Under Alternatives 2, 3, and 5, deer and elk utilizing Diamond Lake during and after the mid September rotenone treatment would be exposed to rotenone treated water. As described in the "Toxicity of Rotenone to Wildlife" section of this document, deer and elk are not expected to be harmed as a result of ingesting water. Alternative 4 would have no meaningful impacts on deer and elk.

LANDBIRD CONSERVATION PLAN CONSISTENCY

Continental and local declines in numerous bird populations have lead to concerns for the future of migratory and resident landbirds. The Forest Service (USDA 2000) and the Partners in Flight Conservation Program have developed a conservation plan to maintain and restore forest habitats necessary to sustain long-term, healthy bird populations. This plan focuses on 28 bird species (see Attachment 2 of the Wildlife Report) representing a range of habitats from stand initiation to old forest and provides recommendations for forest management at both the stand and landscape-scale.

The Landbird Conservation Plan is a habitat-based conservation effort and as such the types of activities proposed under this project are not addressed in the Plan. Alternative 4 would have no impact on landbirds or habitat because none of the proposed activities would alter habitat or potentially harm individuals.

Alternative 1 forgoes the opportunity to address declining water quality and leaves landbirds vulnerable to exposure to toxic algae blooms. As documented in the "Effects of Toxic Algae Blooms on Wildlife" section of this document, algal toxins are known to cause mortality in songbirds. Therefore, under this alternative, it is possible that some landbirds would become ill or die from ingestion of water containing algal toxins during or following a summer bloom at some point in the future. The extent of this potential impact to landbirds over time is unknown.

Alternatives 2, 3, and 5 have the potential to temporarily modify habitat for the Lincoln's Sparrow through the drying of wetlands within the project area. Lincoln's sparrows have been detected at the sewage ponds and occasionally during spring/summer surveys near the Silent Creek wetlands. This short-term impact is considered inconsequential to the species, due to its limited scale and duration, as well as the anticipated low numbers of individuals potentially impacted. There are no management recommendations for this species in the Landbird Conservation Plan other than conducting monitoring and research to determine status, distribution, and habitat relationships for the species. Pre and post project monitoring of the Silent Creek wetlands would occur for these alternatives.

Alternatives 2, 3, and 5 would also result in a temporary loss of aquatic insects in Diamond Lake during the fall of the proposed rotenone treatment. Aquatic insect populations would begin recovery in the spring and summer following treatment and would subsequently be expected to exceed present numbers and species diversity in the years that follow (see Benthic Organism section). Landbirds that prey heavily on aquatic insects could be temporarily displaced to adjacent areas during the fall when aquatic insects are limited within the project area. Young of the year would already be fledged by this time, limiting the consequences of this impact to landbirds. In the long-term, Alternatives 2, 3, and 5 would be expected to beneficially impact those species that utilize aquatic insects as prey. For a complete species list of landbirds, annual bird survey data from the Umpqua Valley Audubon Society (1996-2003) is on file at the Diamond Lake Ranger District. Following consideration of potential impacts, it is determined that these alternatives may temporarily impact landbird habitat, but would not have consequential impacts to the species. These alternatives are considered to be consistent with the Landbird Conservation Plan.

AQUATIC CONSERVATION STRATEGY DISCUSSION

The Aquatic Conservation Strategy (ACS) is aimed at restoring and maintaining the ecological health of watersheds. Its goal is to retain, restore, and protect ecological processes and landforms that contribute habitat elements to streams and promote good habitat conditions for fish and other aquatic and riparian dependent organisms. ACS objectives are discussed in detail in other sections of this document. The ACS objective most relevant to wildlife is #9 – maintain and restore habitat to support well-distributed populations of native plant, invertebrate, and vertebrate riparian-dependent species. For wildlife, ACS discussions are addressed primarily in the context of riparian-dependent mollusks and vertebrate species. Species specific impacts for riparian associated wildlife are discussed in detail throughout this section. Thus, the following represents a broad, general summary that addresses multiple scales. The landscape or watershed scale is the appropriate scale for meeting ACS objectives.

Alternative 1 would maintain existing habitat for riparian associated wildlife species. However, because toxic algal blooms place several species at risk, no action would retard attainment of ACS objective #9 at the 6th field scale. This alternative fails to address declining water quality and loss of aquatic invertebrate diversity and abundance in Diamond Lake and as such has potential long-term negative impacts to some riparian dependent species. Thus, this alternative may retard attainment of this ACS objective at both the project scale and at the landscape scale by perpetuating downstream impacts on water quality in the long term.

Alternatives 2, 3, and 5 would have temporary impacts to riparian habitat on Lake Creek and in Diamond Lake at the project scale. In the longer term, these alternatives would be expected to have a neutral affect on Lake Creek and its associated wildlife, and would be expected to improve the water quality and species diversity and abundance of the aquatic prey base in Diamond Lake. In this context, at both the project and the landscape scale, these alternatives may contribute positively toward meeting habitat restoration objective #9 in the long term.

Alternative 4 would generally maintain existing habitat conditions for riparian associated wildlife species in Diamond Lake and Lake Creek. In the short-term, this alternative would have a primarily neutral influence on attainment of ACS objective #9. In the longer term, at both the project and the landscape scale, this alternative is designed to improve habitat conditions in Diamond Lake and as such, may contribute positively toward meeting ACS objectives in this 5th-field watershed.

OTHER NON-TARGET SPECIES

Analysis of all the following species or species groups is not necessarily required under the Forest Service Biological Evaluation process. However, potential impacts to these species/groups are described for purposes of full disclosure.

Osprey

Ospreys are large birds of prey that breed statewide except in dry treeless southeastern regions and Columbia Basin grasslands. In Oregon, the species generally nests on top of large live trees, snags, or utility poles located within 2 miles of water with an accessible fish population. Ospreys feed almost exclusively on live fish, but dead fish and other non-fish food

items are occasionally utilized. The species experienced a nationwide decline in the 1950's and 60's associated with the widespread use of DDT. DDT was banned in the United States in 1972 and osprey populations have now recovered to historic levels in Oregon and throughout most of their range (Marshall et al. 2003).

AFFECTED ENVIRONMENT

Ospreys utilize Diamond Lake and Lake Creek primarily during the nesting season. The birds generally arrive in the area in early April, breed and nest through the summer, and then begin fall migration in mid September (Pers comm., Ron Maertz, 2003).

The Diamond Lake Restoration project area has likely supported some number of nesting osprey since shortly after 1910 when the lake was first stocked with fish. There are no available data documenting how many osprey nests historically occurred in the vicinity of the lake, nor how osprey responded to the temporarily fishless condition of Diamond Lake following the 1954 rotenone treatment. Fix (1990) summarized his birding observations on the Diamond Lake Ranger District over the seven year time period from 1984-1990. Fix characterized osprey at Diamond Lake as a fairly common summer resident with high nesting success. Anecdotal observations by long-time residents of Diamond Lake indicate that osprey use at the lake appeared to be declining by 1996 (McAuliffe, Correspondence to ODFW, 1996). Surveys completed by the Umpqua Valley Audubon Society from 1996-2002 appear to indicate that the osprey population at Diamond Lake has been relatively stable over the past eight years (Pers. comm., Alice Parker, 2003).

ODFW completed an aerial survey on June 30, 2003 to document osprey nests in and adjacent to the project area. Thirteen osprey nests were observed. Ten nests were located adjacent to Diamond Lake and the other three were along Lake Creek. Six of the osprey nests were active. Reproductive success of these nests is unknown.

Ospreys at Diamond Lake have adapted to a high level of year-round human use. Thus, potential disturbance impacts that don't result in habitat or prey modification are considered very unlikely to occur under any alternatives and will not be discussed.

ENVIRONMENTAL EFFECTS

Direct, Indirect, and Cumulative Impacts:
Alternative 1 perpetuates the existing condition, forgoes the opportunity to address declining water quality and leaves osprey vulnerable to exposure to toxic algae blooms in the future. Under this alternative, it is possible that osprey would become ill or die from ingestion of water containing algal toxins during or following a summer bloom. The extent of this potential impact to osprey over time is unknown.

Alternatives 2, 3, and 5 would have potential impacts to osprey and their habitat. Osprey begin fall migration around mid September in this area. Both historic and recent survey efforts indicate low use of Diamond Lake during the fall season (Fix 1990; Audubon Surveys 1996-2002). However, it is assumed that a small number of indivduals would be present at Diamond Lake during a mid-September rotenone treatment. Osprey would be expected to ingest rotenone treated water and consume rotenone killed fish. However, as described in the "Toxicity of Rotenone to Wildlife" section of this document, they are not expected to be harmed.

Rotenone treatment would temporarily eliminate the fish prey base for this species at Diamond Lake. However, immediately following treatment, birds still present at the lake would likley feed on fish carcasses for a short-time and then would begin or continue migration as the prey base declined and the season progressed. Loss of prey base would likely have the greatest potential impacts on osprey during the following spring and summer when birds returned to the lake to nest. During this breeding season, lack of a fish prey base could compromise nesting success for the species. The supplemental feeding program described for bald eagles may help[20] mitigate this effect. However, it is still expected that reproductive success would be reduced for some of the six pairs of osprey currently nesting at Diamond Lake for one to two breeding seasons. Monitoring of reproductive success would occur during the supplemental feeding program and for two years following restoration of the fish prey base.

As described in detail in the bald eagle section, Alternatives 2, 3, and 5 would be expected to improve future habitat in the planning area by restocking with trout. Increases in the availability of a larger prey item (trout) could result in a return to higher numbers of nesting osprey at Diamond Lake in the future. Alternative 3 would be expected to provide a higher number or larger prey items more quickly than Alternative 2 because Alternative 3 proposes stocking with legal-sized fish while Alternative 2 is primarily a fingerling based stocking strategy.

For Alternatives 2, 3, and 5, when considered in the context of past, present, and reasonable foreseeable activities in the project area (Tables 9-11), it is expected that potential impacts would have insignificant consequences to the species because: potential negative impacts are limited to one or two breeding seasons followed by a long-term improvement in habitat; the supplemental feeding program may reduce the intensity of the impact; populations of osprey on the Forest and state-wide are stable; and ongoing and reasonably foreseeable actions that would modify osprey habitat are limited. Implementation of the contingency plan associated with this alternative could result in an additional disturbance impacts and removal of prey items during mechanical fish harvest. Additional large fish would also be added to the lake under the contingency plan, representing a potential positive impact.

Alternative 4 would utilize commercial fish operations for approximately two months in June and July and one month in September on an annual basis to harvest tui chub from Diamond Lake. It is possible that osprey could be harmed by becoming entangled in gill nets during commercial fishing operations (Pers. com. Dave Loomis). It is considered unlikely that this potential impact would occur frequently enough to represent a significant impact to the species. However, to mitigate this potential impact, to the greatest extent practical, net operators would be required to disentangle and free birds that become entangled in fishing nets. Commercial fishing would also reduce the available prey base for osprey during the breeding season. These activities would disrupt foraging during the breeding season, but are not expected to hinder reproductive success because commercial fishing areas would be staggered, allowing undisturbed access to the majority of the lake at a given point in time and adequate prey base would likely remain in Diamond Lake throughout the lifetime of the project. This is considered to be an insignificant effect to the species. When considered in the context of past, present, and reasonable foreseeable activities in the project area, potential impacts associated with this alternative are expected to have insignificant consequences to

[20] Research conducted during a supplemental feeding program at Hyatt Reservoir documented a 52% decline in osprey productivity following a rotenone treatment compared to nest success at a nearby reservoir (Kaiser 2004).

the species because: impacts are limited in scale and intensity; populations of osprey on the Forest and state-wide are stable; and ongoing and reasonably foreseeable actions that would modify osprey habitat are limited. Implementation of the contingency plan under this alternative would have similar impacts as those described for Alternatives 2, 3, and 5.

Conclusions:
Alternative 1 represents the greatest sustained risk to osprey at Diamond Lake because of the continued presence of toxic algae blooms over time. Alternatives 2, 3, and 5 have greater potential short-term adverse effects than Alternative 4 but may have a higher potential for achieving and maintaining long-term habitat improvement through improved water quality than Alternatives 1 or 4 (See Water Quality Sections for details). There are no measureable differences between Alternatives 2, 3, and 5 with regard to effects to this species.

Following consideration of the direct, indirect and cumulative impacts of the proposed activities, it is determined that Alternatives 1, 2, 3, 4, and 5 may temporarily impact osprey, but, would not have consequential impacts to the species.

Waterbirds

AFFECTED ENVIRONMENT

Diamond Lake proper provides nesting habitat for a number of waterfowl, shorebirds, and other water-associated bird species, but is probably most important as a fall migration stop for waterfowl. Additionally, the sewage ponds just northeast of Diamond Lake are considered to be important nesting and migration stopover habitat for this species group in the summer and fall. Based on extensive birding experience, Fix (1990) characterized waterbird utilization of Diamond Lake from 1984-1990 as remarkable for supporting heavy use by both humans and waterfowl[21]

In 2000-2002, from 10-25 bird species that rely solely or primarily on fish or aquatic insect prey were detected during point-count surveys by the Umpqua Valley Audubon Society at the south end of Diamond Lake. All of the species documented in Table 4 were present during the 2000, 2001, or 2002 survey seasons in numbers greater than 10. Fall surveys did not occur after mid to late September.

[21] "Diamond Lake is remarkable for supporting heavy use by both humans and waterfowl. From October into December, a fine concentration of dabbling and diving ducks, grebes, coots, and gulls may be found assembled on the south portion of the lake. Submergent vegetation offers a strong attraction for these birds, and they feed heavily in preparation for the flight to wintering grounds elsewhere. Thousands of American Coots, hundreds of American Wigeon and Lesser Scaup, and dozens of Common and Hooded Mergansers dot the lake at this time. Loons, Red-necked Grebe, Clark's Grebe, Surf and White-winged Scoters, Red-breasted Merganser, Eurasian Wigeon, and Herring and Bonaparte's Gulls have been seen among this flock.

The sheltered northwest corner of the lake supports a small flock of waterfowl concurrently, chiefly Barrow's Goldeneyes, Buffleheads, Eared Grebes, and the occassional loon.

The lake is slow birding during much of the rest of the year. Small numbers of migrant waterfowl appear on the lake during mid- and late spring. Common loons and Horned Grebes are probably regular at this time. Barrow's Goldeneye is by far the most common nesting duck, and family groups may be encountered anywhere along the lakeshore from June into September (Fix 1990).

Table 4. Waterbirds detected in numbers greater than 10 during the 2000-2002 surveys at the South Shore Picnic Area and South Shore Meadows Survey Points on Diamond Lake.

Species	Spring/ Summer Survey Date	Highest Number of Individuals Documented in Spring/Summer	Fall Survey Date	Highest Number of Individuals Documented in Fall	Survey Location
Pied-billed grebe	8/23/00	11	9/11/00	51	SS Meadow
Western grebe	8/22/00	55	9/11/00	179	SS Meadow
California gull	8/23/00	29	9/11/00	24	SS Meadow
No species were detected in numbers greater than 10 in the 2001 surveys					SS Meadow
Common merganser	7/25/02	128	-----	-----	SS Meadow
Pied-billed grebe	8/30/00	16	9/13/00	22	SS Picnic Area
Western grebe	7/19/00	120	9/13/00	174	SS Picnic Area
American wigeon	-----	-----	9/28/00	30	SS Picnic Area
Common merganser	-----	-----	9/13/00	87	SS Picnic Area
American Coot	-----	-----	9/28/00	360	SS Picnic Area
California gull	8/10/00	17	9/28/00	31	SS Picnic Area
Western grebe	8/10/01	195	-----	-----	SS Picnic Area
Clark's grebe	6/18/01	110	-----	-----	SS Picnic Area
Common merganser	6/2/01	10	-----	-----	SS Picnic Area
California gull	8/10/01	35	9/15/01	17	SS Picnic Area
Western grebe	8/8/02	428	No September survey data was available for the South Shore Picnic Area.		
Clark's grebe	7/11/02	21			
Common merganser	7/31/02	161			
California gull	6/20/02	44			
Double-crested cormorant	8/8/02	12			
Tree swallow*	8/8/02	29			
Violet green swallow*	7/31/02	17			
Barn swallow*	7/31/02	57			

***** These species are not dependent on aquatic insects, but would utilize them heavily at Diamond Lake.

Other waterbirds known to use Diamond Lake, which are closely tied to a fish prey base but do not occur in high numbers are: the great blue heron and belted-kingfisher. For a complete species list of waterbirds, annual bird survey data from the Umpqua Valley Audubon Society (1996-2003) is on file at the Diamond Lake Ranger District.

ENVIRONMENTAL EFFECTS

Direct, Indirect, and Cumulative Impacts:

Alternative 1 forgoes the opportunity to address declining water quality and leaves waterbirds vulnerable to exposure to toxic algae blooms. As documented in the "Effects of Toxic Algae Blooms on Wildlife" section of this document, algal toxins are known to cause mortality in waterbirds. Thus, under this alternative, it is expected that some waterbirds would become ill or die from ingestion of water containing algal toxins during or following a summer bloom at some point in the future. The extent of this potential impact to water birds over time is

unknown; however, large populations make loss of viability of these species improbable. Alternative 1 would also indirectly impact these species by perpetuating lake conditions that support a limited and declining future population of aquatic macroinvertebrates (see Fish section).

Alternatives 2, 3, and 5 would have potential impacts to waterbirds and their habitat. Waterbirds would be expected to ingest rotenone treated water and consume rotenone killed prey species. However, as described in the "Toxicity of Rotenone to Wildlife" section of this document, they are not expected to be harmed. Waterfowl, shorebirds, and others that forage primarily on fish or aquatic insects and traditionally utilize Diamond Lake as a fall migration stop over would likely not have an adequate prey base in the late fall and early winter following a rotenone treatment. These birds would probably be displaced to habitat further south on their migration routes (Pers comm. Alice Parker). It is possible that some weaker individuals might not survive the extended migration. Similarly, in the spring/summer following treatment, the lake ecosystem would not have recovered sufficiently to support the water species that it traditionally supports. Again, some displacement to adjacent habitats would be expected. These habitat and displacement impacts are short-term impacts and would be expected to occur for two fall seasons and one to two spring/summer seasons.

When the lake recovers, Alternatives 2, 3, and 5 would be expected to result in a beneficial indirect impact to waterbirds by facilitating the return of a more abundant and diverse aquatic macroinvertebrate prey base for insectivorous species, as well as a fish prey base for piscivorous birds (see Fish section).

For Alternatives 2, 3, and 5, when considered in the context of past, present, and reasonable foreseeable activities in the project area, it is expected that potential impacts would have insignificant consequences to waterbird species because: potential negative impacts are limited to one or two breeding and migration seasons followed by a long-term improvement in habitat; availability of alternative habitat further along on the bird's migration routes would reduce the intensity of the impact; the majority of these species occur in very large numbers; and ongoing and reasonably foreseeable actions that would modify habitat within the project area are limited. Implementation of the contigency plan in association with this alternative would extend the time period of potentially disturbing activities from tui chub removal by an additional five years and beyond.

Alternative 4 would utilize commercial fish operations for approximately two months in June and July and one month in September on an annual basis to harvest tui chub from Diamond Lake. It is expected that some waterbirds could be harmed or killed by becoming entangled in gill nets during commercial fishing operations (Pers. comm. Dave Loomis). Because these species generally occur in very large numbers across their range it is considered unlikely that this potential impact would occur frequently enough to represent a significant impact to the species. To mitigate this potential impact, to the greatest extent practical, net operators would be required to disentangle and free birds that become entangled in fishing nets. Commercial fishing would also reduce the available prey base for piscivorous species during the breeding season. These activities would disrupt foraging during the breeding season, but are not expected to hinder reproductive success because commercial fishing areas would be staggered, allowing undisturbed access to the majority of the lake at a given point in time and adequate prey base would likely remain in Diamond Lake throughout the lifetime of the project. This is considered to be an insignificant effect to these species. Fish stocking would also result in added prey base for some of the larger piscivorous waterbirds. When considered

in the context of past, present, and reasonably foreseeable activities in the project area, potential impacts associated with this alternative are expected to have insignificant consequences to the species because: impacts are limited in scale and intensity; these species generally occur in very large numbers across their range, and ongoing and reasonably foreseeable actions that would modify habitat within the project area are limited. Implementation of the contigency plan in association with this alternative would extend the time period of potentially disturbing activities by an additional five years and beyond.

Conclusions:
Alternative 1 represents the greatest sustained risk to waterbirds at Diamond Lake over time through exposure to algal toxins. Alternatives 2, 3, and 5 have greater potential short-term adverse impacts than Alternative 4, but may have a higher potential for achieving and maintaining long-term habitat improvement through improved water quality and prey base than Alternatives 1 or 4 (See Water Quality Sections for details).There are no meaningful or measureable differences between Alternatives 2, 3, and 5.

Following consideration of the direct, indirect and cumulative impacts of the proposed activities, it is determined that Alternatives 1, 2, 3, 4, and 5 may temporarily impact waterbirds, but would not have consequential impacts to any species.

Reptiles and Amphibians (Herps)

AFFECTED ENVIRONMENT

No surveys are required for amphibians or reptiles that are not included on the Regional Forester Sensitive Species list or Survey and Manage list. However, systematic surveys of habitat in Diamond Lake and Lake Creek were completed in 1996 and 1997.

Professional herpetologist, Marc Hayes assembled historical data and conducted surveys of the aquatic amphibian and reptile fauna of Diamond Lake in 1996 (Hayes 1997). The following seven species were documented: western toad; pacific chorus frog; Cascades frog; northwestern salamader; long-toed salamander; rough-skinned newt and common garter snake. Surveys of Lake Creek conducted by Hayes in 1997 documented the same species with the following exceptions: long-toed salamaders were not detected and an additional species the northwestern garter snakes was documented (Hayes 1998).

The majority of these species are common on this Forest and in Oregon and are not included on ODFW or Oregon Natural Heritage Program (ONHP) species of concern lists. The Cascade frog is coded as "Sensitive-Vulnerable" by ODFW; and "not rare, apparently secure throughout range" and "rare, threatened or uncommon in Oregon" by ONHP. The western toad is coded "Sensitive-Vulnerable" by ODFW and "not rare, apparently secure throughout range and in Oregon" by ONHP.

Hayes (1997, 1998) notes that both Diamond Lake and Lake Creek are currently poor quality habitat for amphibians for a variety of reasons including: predatory fish, high pH, low prey availability, lack of protected still water habitats, etc. The author notes that most amphibian

recruitment occurs off Diamond Lake proper and concludes that collectively, the data indicate that Diamond Lake is a sink[22] for amphibians.

ENVIRONMENTAL EFFECTS

Direct, Indirect, and Cumulative Impacts:
Alternative 1 perpetuates the existing condition, forgoes the opportunity to address declining water quality and leaves herps vulnerable to exposure to toxic algae blooms in the future. Under this alternative, it is possible that some herps would become ill or die through ingestion, absorption, or respiration of algal toxins during or following a summer bloom. The extent of this potential impact to herps over time is not known.

Alternatives 2, 3, and 5 would have potential impacts to aquatic herps and their habitat. Both increased flows and dewatering of portions of Lake Creek associated with the draw down of Diamond Lake would impact herps on Lake Creek. Hayes (1998) documented that the overall numbers of herps recorded along the channel of Lake Creek were extremely low. He noted that a number of factors likely contribute to these low numbers including presence of predacious fish, lack of stillwater habitat, and low water quality. Hayes described that well over 99% of the amphibian and reptile observations made during surveys of Lake Creek were recorded at off-channel sites lacking a direct surface connection to Lake Creek, and that nearly all of the observations were made at two off-channel sites below Highway 138 - Long Marsh and Pit Lakes. Changes in flow on Lake Creek would have no measureable impact on Long Marsh and Pit Lakes (Pers. comm. Steve Hofford). Additionally, both the increased and decreased flows on Lake Creek would occur primarily in the late fall through winter season when effects to most amphibians would be reduced. Based on the above information, it is believed that a limited number of individuals would be impacted by these activities.

Hayes (1998) notes the possibility of negative impacts to amphibian habitat associated with the draw down, but does not reach definitive conclusions. Due to the low quality of existing habitat and low potential for the habitat to serve as other than "sink" habitat in the future, these habitat impacts are considered to be insignificant to the herptofauna of Lake Creek.

The draw down could also affect amphibians through potential impacts to Horse and Teal Lakes just south of Diamond Lake. Several factors such as snow melt and precipitation make those impacts difficult to predict with accuracy; however, it is considered likely that by the late spring or early summer, there may not be available open water to support amphibian reproduction in these lakes (see Groundwater sections for details). This potential impact may be the most serious impact to amphibians because these areas support the most amphibian reproduction in the near vicinity of Diamond Lake (Hayes 1997).

The proposed September rotenone treatment has the potential to result in direct mortality to some individual herps that utilize Diamond Lake (particularly gill-breathing life forms). Hayes (1997) notes that for the seven species documented during the 1996 surveys amphibian use of Diamond Lake appears to be limited for all species except the rough-skinned newt. In particular, the western toad, Cascades frog, and long-toed salamanders showed no evidence of reproduction in Diamond Lake in 1996 (Hayes 1997).

[22] Habitat where death and individuals leaving the population is greater than birth and individuals moving into the population.

Hayes (1997) documents that "Mortality from rotenone treatment would probably be restricted to individuals that remain in the draw down application pool from the already low late-summer numbers likely to be present around the lake. Based on life histories of amphibians present, except for the northwestern salamander and rough-skinned newt, numbers of individuals subject to mortality are likely to be few to nil (pg. 1)." No direct mortality from rotenone treatment would be expected in Lake Creek because treated water would be confined to Diamond Lake. Rotenone treatment would also temporarily eliminate the aquatic insect prey base in the lake. Although little or no mortality would be expected for garter snakes (reptiles), they would be indirectly impacted through a loss of amphibian prey base.

Because rotenone treatment would result in the loss of some amphibians in Diamond Lake and because Horse and Teal Lakes, the areas considered most likely to support recolonization of the lake following treatment (Hayes 1997) would be impacted under these alternatives, post project monitoring for amphibians would occur for Diamond, Horse, and Teal Lakes. If amphibian populations and species diversity do not recover naturally active transplanting of amphibians back into these lakes would occur (see mitigation in Chapter 2).

When considered in the context of past, present, and reasonable foreseeable activities in the project area, it is determined that Alternatives 2, 3, and 5 may impact individuals or habitat, but are not likely to contribute to a trend toward federal listing or loss of viability of any species. This conclusion is based on the following rationale: although numbers are likely lower the Diamond Lake vicinity still retains the entire aquatic amphibian and reptile fauna it had historically and that would be anticipated at this elevation (Hayes 1997); low levels of direct mortality are expected for most species; most species are either common on the landscape or potential impacts to the species are minimal (i.e. western toad and Cascade frog); negative impacts to aquatic prey base are short-term and potential improvement of prey base in the long-term is expected; and sources of individuals for passive and active recolonization exist in the immediate vicinity (Pit Lakes and Long Marsh).

Alternative 4 would have minor potential impacts to aquatic herps. Individuals could be harmed or killed during commercial fishing operations in the lake. Dragging nets or seines through aquatic vegetation could damage egg masses and further limit reproduction in the lake. When considered in the context of past, present, and reasonable foreseeable activities in the project area it is determined that Alternative 4 may impact individuals or habitat, but is not likely to contribute to a trend toward federal listing or loss of viability of any species. This conclusion is based on the following rationale: although numbers are likely lower, the Diamond Lake vicinity still retains the entire aquatic amphibian and reptile fauna it had historically and would be anticipated at this elevation (Hayes 1997); low levels of direct mortality are expected for most species; and most species are either common on the landscape or potential impacts to the species are insignificant.

Conclusions:
Alternatives 1, 2, 3, and 5 have a higher potential to adversely affect herps than Alterantive 4. Alternative 1 represents a sustained risk to the species and predicted losses of some number of individuals through exposure to algal toxins. Alternatives 2, 3, and 5 represent a short-term impact to the species and known losses of some number of individuals through rotenone treatment mortality.

Alternatives 2, 3, and 5 may have a higher potential for achieving and maintaining long-term habitat improvement through improved water quality than Alternatives 1 or 4 (See Water Quality Sections for details). However, these differences may not be meaningful to this species groups because proposed fish stocking under all alternatives lowers the habitat effectiveness of Diamond Lake for amphibians.

Following consideration of the direct, indirect and cumulative effects of the proposed activities, it is determined that:

> Alternatives 2, 3, and 5, as mitigated, may temporarily impact amphibians, but would not have long-term consequential impacts to any species.
>
> Alternatives 1 and 4 may temporarily impact amphibians, but would not have long-term consequential impacts to any species.

Bats

AFFECTED ENVIRONMENT

Diamond Lake and the surrounding terrestrial environments are potential habitat for a variety of bats. ODFW biologist Terry Farrell compiled a list of ten bat species that are known or suspected to occur in the Diamond Lake area (Pers. comm., Terry Farrell). This species list was validated by two other bat biologists (Pers. comms., Dr. John Hayes, Pat Ormsbee). All of these bats are insectivorous and opportunistic, although some species seem to be more selective of moths, beetles, or flies. These species all tend to capture their prey while in flight and most are thought to be associated with forest openings and/or water (Verts and Carraway 1998).

A list of the ten species, along with abundance and a brief habitat and prey description, follows are described in Table 5 below (the fringed myotis bat was addressed earlier in this document).

Table 5. Potential bat species at Diamond Lake and their habits and habitats.

Species	Habitat and Prey Description
Little Brown Bat	Common and widespread. Inhabits forests generally near water. Diet consists mostly of true flies, especially chironomids, with termites and caddisflies also being consumed.
Yuma Myotis	Uncommon to rare. This species is strongly associated with habitats near water. Typical forage consists mostly of true flies with lower numbers of termites and moths consumed as well.
Long-eared Myotis	Uncommon in western Oregon. Conifer forest associated. This species forages by picking their prey from the surfaces of various types of substrate (bark, leaves, rocks, the ground, etc.). Prey for this "hovering gleaner" includes mostly moths and beetles, with lower numbers of spiders, true flies, and other insects.
Fringed Myotis	Probably uncommon in Oregon. Associated with caves/mines in forests. Their diet consists mostly of moths and spiders, with some beetles and true flies also preyed upon.
Long-legged Myotis	Common in Oregon. Strongly associated with mature conifer forests. Feeds almost exclusively on moths, although is known to consume

Species	Habitat and Prey Description
	spiders, termites, and other insects.
California Myotis	Common in western Oregon. Old growth associated, often near water, they use bark for roosting. Prey includes mostly true flies (Diptera), with lower percentages of moths, caddisflies, spiders, and termites.
Silver-haired Bat	Abundance poorly known, likely uncommon. Strongly associated with mature forests. This species' diet consists mostly of moths, termites, and true flies, however they utilize a number arthropod taxa in smaller percentages.
Big Brown Bat	Common and widespread. Associated with coniferous and deciduous forests. This species consumes mostly beetles and moths, although also will opportunistically forage on true flies, termites, and a variety of other insects.
Hoary Bat	Uncommon in western Oregon. Strongly associated with coniferous or mixed stands. Prey consists almost exclusively of moths although they are known to eat true flies and other insects.
Townsend's Bat	Uncommon. Associated with caves and mines in forested areas. This bat feeds selectively on moths with very little variation in prey type.

Little is known about the migratory habits of most of these bats species. Silver-haired and hoary bats in Oregon are known to migrate in the fall to southern California and Mexico. The remaining species likely migrate in the fall at least to lower elevations (Pers. comm. Dr. John Hayes) and all generally hibernate in winter. However, individuals of some species may awaken and feed periodically during periods of warm winter weather at low elevations.

ENVIRONMENTAL EFFECTS

Direct, Indirect, and Cumulative Impacts:
Alternative 1 would indirectly impact these species by perpetuating lake conditions that support a limited and declining future population of aquatic insects (see Fisheries section for details). It is also possible that bats would be harmed or killed by ingesting algal toxins during or following a bloom.

Alternatives 2, 3, and 5 have potential impacts on both individuals and habitat of these species. These alternatives would dewater portions of Lake Creek for approximately 2 months in the late fall (mid September – mid November) and low water conditions would persist for several months, reducing available aquatic prey in the dewatered/low water areas. These alternatives also propose a rotenone treatment that would eliminate most aquatic insects from Diamond Lake in about mid September. Although all of these bats are probably starting to move to lower elevations by mid September, species presence is assumed. Additionally, although many bat species prey heavily on terrestrial insects (moths, beetles, etc.), all will forage on aquatic insects to some extent and thus would be potentially impacted to a greater or lesser degree by a loss of aquatic prey base.

Potential direct, indirect and cumulative impacts to the other nine bat species described above would be essentially the same as those described for the fringed myotis bat earlier in this section. Species such as the Yuma myotis and the little brown bat that are more reliant on aquatic insects as a primary forage item are likely to incur greater impacts than species such as the long-legged myotis or the Townsend's bat that feed almost exclusively on moths. However, for all of the above species, impacts to the aquatic prey base are expected to have

insignificant consequences to their populations because: bats are opportunistic, generalist feeders and are not likely dependent on a single source or location for food; there is available foraging habitat adjacent to the project area if bats were temporarily displaced as a result of the lack of aquatic prey; and many bats have likely already moved down to lower elevations during this time of year (Pers. comm., Dr. John Hayes, Pat Ormsbee).

Indirect impacts to the abundance and diversity of the future aquatic prey base for these bats at Diamond Lake are uncertain under Alternative 4 due to the fact that only a portion of the tui chub population would be removed and tui chub are very effective predators on aquatic macroinvertebrates. However, it is assumed that positive impacts to aquatic insects would be realized (see Fish section). Implementation of contingency plans for all action alternatives may increase the likelihood of maintaining habitat improvements in the long-term.

Conclusions:
Alternative 1 represents the greatest sustained risk to these bats over time. Alternatives 2, 3, and 5 have greater potential short-term adverse effects than Alternative 4, but may have a higher potential for achieving and maintaining long-term habitat improvement through improved water quality than Alternatives 1 or 4 (See Water Quality Sections for details). There are no meaningful or measureable differences between Alternatives 2, 3, and 5 with regard to impacts to these species.

Following consideration of the direct, indirect and cumulative impacts of the proposed activities, it is determined that Alternatives 1, 2, 3, 4, and 5may temporarily impact bats, but would not have long-term consequential impacts to any species.

Other Mammals

AFFECTED ENVIRONMENT

The Diamond Lake area has a number of mammal species that are known to occur in the area, but do not receive special consideration for their management. Some of these species may be affected by the Diamond Lake Restoration Project and include the American beaver, common raccoon, American marten, ermine, long-tailed weasel, mink, and river otter. Most of these species are aquatic, semi-aquatic, or riparian associated. Table 6 compiled from wildlife sighting information and Verts and Carraway (1998) identifies some of their habitat and forage characteristics.

Table 6. Other mammals at Diamond Lake and their habits and habitats.

Species	Habits and Habitats
American beaver	Common and widespread. Associated with aquatic and riparian habitats. Forages on herbaceous and woody vegetation that grows near water.
Common raccoon	Common and widespread. Strongly associated with water and/or forested habitats. May also be associated closely with areas of human activity. A dietary generalist, raccoons eat almost anything organic.
American marten	Uncommon and restricted to higher elevations in Oregon. Martens are associated with contiguous forests that have high canopy closure. Forage consists mostly of mammals, although birds, insects, and fruit are known to be consumed seasonally.
Ermine	Uncommon and widespread. Ermine are associated with early successional habitats as well as forests. Preys upon small mammals that are

Species	Habits and Habitats
	typically no larger than mouse-sized and occasionally on birds and earthworms.
Long-tailed weasel	Uncommon and widespread. Long-tailed weasels occupy a wide variety of habitats ranging from mature forests to alpine tundra. Diet consists mostly of small mammals up to rabbit sized, although they are considered opportunists that will eat most vertebrate species encountered.
Mink	Uncommon and widespread. Mink are strongly associated with water and wetlands. Prey consists mostly of fish, mammals, and crayfish, although birds and reptiles are eaten as well.
River otter	Uncommon and widespread. River otters are aquatic obligates and are strongly associated with water habitats. Their prey consists mostly of fish, although they are known to consume crustaceans, amphibians, birds, and mollusks as well.

ENVIRONMENTAL EFFECTS

Direct, Indirect, and Cumulative Impacts:
Alternative 1 perpetuates the existing condition and forgoes the opportunity to address declining water quality in Diamond Lake. For species such as beaver, raccoon, mink and river otter that spend a significant portion of their lives in water or prey primarily on aquatic species, it is possible that some individuals would become ill or die from exposure to algal toxins during or following a summer bloom. It is also possible that any of the mammals could drink from the lake and be exposed to toxins. The extent of these potential impacts over time is unknown. There are no anticipated impacts to other mammals that are not aquatic associates.

Alternatives 2, 3, and 5 have potential impacts to individuals and habitats of some of these species. Beaver, raccoon, mink, and river otter spend a significant portion of their lives in water or prey primarily on aquatic species. These species have the greatest potential to be affected by proposed activities. All of the above species would be expected to ingest rotenone treated water and consume rotenone killed prey species. However, as described in the "Toxicity of Rotenone to Wildlife" section of this document, they are not expected to be harmed. Rotenone treatment would eliminate aquatic prey species for river otter, raccoons, and mink in Diamond Lake proper for one to two summers. It is expected that individuals of these species would be temporarily displaced to adjacent habitats within the project area (i.e. Silent and Lake Creeks and tributaries). Alternatives 2, 3, and 5 would be expected to result in a future beneficial indirect impact to these species by facilitating the return of a more abundant and diverse aquatic macroinvertebrate prey base as well as a fish prey base.

Minor impacts to beavers would be expected as a result of the draw down. During the winter of the draw down, receding water levels would create an increased distance between the lodges, the beaver's winter food stash, and the lake water. It is doubtful that these habitat modifications would harm the beavers, but it likely represents an additional energetic expense for individuals.

The dewatering and low flow periods on Lake Creek associated with the proposed draw down represent a temporary modification of habitat and prey base for all of the seven species identified above. Although individuals could be affected, consequences to these species are considered to be minor due to the limited scale of the action and the availability of adjacent habitat within the project area.

For Alternatives 2, 3, and 5, when considered in the context of past, present, and reasonable foreseeable activities in the project area (Tables 9-11), it is expected that potential impacts would have insignificant consequences to these mammal species because: potential negative impacts are short-term followed by a long-term improvement in habitat; availability of alternative habitat within and adjacent to the project area would reduce the intensity of the impact; and the number of individuals potentially impacted is expected to be limited. If/when tui chub return, and contingency plans fail, negative impacts to the aquatic macroinvertebrate prey base would be expected to recur.

Alternative 4 would utilize commercial fish operations for approximately two months in June and July and one month in September on an annual basis to harvest tui chub from Diamond Lake. It is expected that occassionally beaver, river otter, and possibly mink could be harmed or killed by becoming entangled in gill nets during commercial fishing operations (Pers. comm., Dave Loomis). It is considered unlikely that this potential impact would occur frequently enough to represent a significant impact to these species. However,to mitigate this potential impact, to the greatest extent practical, net operators would be required to disentangle and free animals that become entangled in fishing nets. Commercial fishing would also reduce the available prey base for piscivorous[23] species. Annual fish stocking would also result in added prey base. Because commercial fishing areas would be staggered allowing undisturbed access to the majority of the lake at a given point in time and adequate prey base would likely remain in Diamond Lake throughout the lifetime of the project. This is considered to be an insignificant effect to these species. When considered in the context of past, present, and reasonable foreseeable activities in the project area, potential impacts associated with this alternative are expected to have insignificant consequences to these species because impacts are limited in scale and intensity and the number of individuals potentially impacted is expected to be limited.

Implementation of the contigency plan in association with all action alternatives would extend the time period of potentially disturbing activities to these species by an additional five years and beyond.

Conclusions:
Alternative 1 represents the greatest sustained risk to some of these mammal species over time through exposure to toxic algae blooms. Alternatives 2, 3, and 5 have greater potential short-term adverse effects than Alternative 4, but may have a higher potential for achieving and maintaining long-term habitat improvement through improved water quality than Alternatives 1 or 4 (See Water Quality Sections for details). There are no meaningful or measureable differences between Alternatives 2, 3, and 5. Following consideration of the direct, indirect and cumulative impacts of the proposed activities, it is determined that Alternatives 1, 2, 3, and 4 may temporarily impact some of these mammals, but would not have long-term consequential impacts to any species.

MITIGATIONS & MONITORING

Certain actions can be taken to reduce potential impacts or effects to PETS species and other wildlife and facilitate maintenance of viable populations of existing native wildlife in the

[23] Piscivorous means “fish-eating”.

planning area. Mitigations and monitoring recommended for reducing impacts and maintaining viable wildlife populations are described below. Unless otherwise stated, these recommendations would apply to Alternatives 2, 3 and 5.

1. Implement a supplemental bald eagle and osprey feeding program during the time period when the fish population in Diamond Lake is non-existent or limited. (A detailed plan would be developed jointly by the USFWS, ODFW, and the USFS).

2. Monitor osprey and bald eagle reproductive success during the supplemental feeding program and for two years following restoration of the fish prey base. (Eagle reproductive success would be monitored annually until the species is delisted).

3. Complete post-project monitoring for amphibians in Diamond, Horse, and Teal Lakes. If amphibian populations and species diversity do not recover naturally, transplant individual amphibians from Long Marsh, Pitt Lakes, and Three Lakes (known long-toed salamander breeding area) into suitable habitat in Diamond, Horse, and Teal Lakes to facilitate recolonization of amphibians in these areas.

4. Conduct pre- and post- draw down monitoring of soil moisture and species presence at known sites of the Crater Lake tightcoil snail. If post-project surveys reflect that the species appears to be absent at any of the sites, translocate a number of individuals from adjacent known sites with multiple adults (i.e. Crystal Springs) to repopulate the site.

5. Conduct pre- and post- draw down monitoring of Silent Creek wetlands to facilitate understanding of how this type of temporary habitat manipulation impacts utilization of habitat by Lincoln's sparrows.

6. For Alternative 4, to the greatest extent practical, disentangle and free non-target birds or mammals that become entangled in fishing nets.

SUMMARY TABLE

Effects/Impacts determinations are documented in Table 7 for Threatened, Endangered and Sensitive Wildlife Species.

Table 7. Determination of effects to Threatened, Endangered, and Sensitive and Wildlife Species.

Review Process	Conclusion of Effects, based on pre-field review, field verification, and determination of effects. Determination of effects by Alternative				
Birds	**1**	**2**	**3**	**4**	**5**
Northern Spotted Owl	NE	LAA	LAA	LAA	LAA
Bald Eagle	LAA	LAA	LAA	LAA	NLAA
Peregrine Falcon	NI	NI	NI	NI	NI
Harlequin Duck	MIIH	MIIH	MIIH	MIIH	MIIH
Bufflehead	MIIH	MIIH	MIIH	MIIH	MIIH
Yellow Rail	NI	MIIH	MIIH	NI	MIIH
Black Swift*	NI	NI	NI	NI	NI
Amphibians					
Oregon Spotted Frog	MIIH	MIIH	MIIH	MIIH	MIIH
Foothill Yellow-legged Frog	NI	NI	NI	NI	NI
	1	**2**	**3**	**4**	**5**
Southern Torrent Salamander	NI	NI	NI	NI	NI
Reptiles					
Western Pond Turtle	NI	NI	NI	NI	NI
Common Kingsnake	NI	NI	NI	NI	NI
Mammals					
California Wolverine	MIIH	MIIH	MIIH	MIIH	MIIH
Pacific Fisher	MIIH	MIIH	MIIH	MIIH	MIIH
Pacific Fringed Bat	MIIH	MIIH	MIIH	MIIH	MIIH
Pacific Pallid Bat	NI	NI	NI	NI	NI
Pacific Shrew	MIIH	MIIH	MIIH	NI	MIIH
Mollusks					
Crater Lake Tightcoil Snail *	NI	MIIH	MIIH	NI	MIIH
Oregon Shoulderband Snail*	NI	NI	NI	NI	NI
Chace Sideband Snail*	NI	NI	NI	NI	NI
Insect					
Fender's Blue Butterfly*	NI	NI	NI	NI	NI

Key to determinations:
The threatened and endangered species determination calls follow the nomenclature established by the US Fish and Wildlife Service:

NE= No Effect, NLAA= Not Likely to Adversely Affect, LAA= Likely to Adversely Affect

For sensitive species, determinations follow the nomenclature established in the Forest Service Handbook:

NI= no Impact;
MIIH= May Impact Individuals or Habitat but will not Likely Contribute to a Trend Towards Federal Listing or Cause a Loss of Viability to the Population or Species;
WIFV= Will Impact Individuals or Habitat with a Consequence that the Action May Contribute to a Trend Towards Federal Listing or Cause a Loss of Viability to the Population or Species.

* Added to the sensitive species list following publication of the DEIS.

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